PROJECT MANUAL
Volume 1 of 2

Prototype #2
Elementary School #38

LAMAR CISD

100% Construction Documents
December 12, 2024

CSP# 03-2025

Project No. 24-028

pfluger

2 Greenway Plaza, Suite 460
Houston, Texas 77046
P: 713.222.1141
F: 713.222.1174
pflugerarchitects.com

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List of Specifications, As Prepared by:

pfluger

2 Greenway Plaza, Suite 460
Houston, Texas 77046
P: 713.222.1141

12-12-2024

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10 14 00 - ARCHITECTURAL SIGNAGE
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END OF SECTION 00 01 10.1

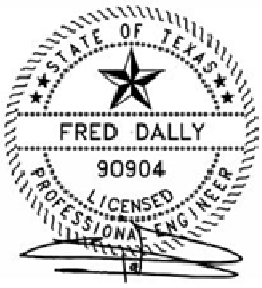
SECTION 00 01 10.2 **TABLE OF CONTENTS: CIVIL ENGINEER**

List of Specifications, As Prepared by:

CIVIL

DALLY + ASSOCIATES
9800 Richmond Ave Ste 460
HOUSTON, TX 77042
P: (713) 337-8881

END OF SECTION 00 01 10.2



12/12/2024

SECTION 00 01 10.3 TABLE OF CONTENTS: LANDSCAPE ARCHITECT

List of Specifications, As Prepared by:

LANDSCAPE

MARY GOLDSBY ASSOCIATES
112 NORTHWOOD STREET
HOUSTON TX 77009
P: (713) 802-2799

Mary Goldsby, PLA, ASLA

12-12-24

NUMBER TITLE

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32 84 00 Landscape Irrigation
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END OF SECTION 00 01 10.3

SECTION 00 01 10.4 TABLE OF CONTENTS: STRUCTURAL ENGINEER

List of Specifications, As Prepared by:

STRUCTURAL

MATRIX STRUCTURAL
5177 Richmond Ave Ste 670
HOUSTON, TX 77056
P: (713) 664-0130

Matrix Structural Engineers
TBPE Firm Registration No. F-2640

12/12/2024

NUMBER TITLE

END OF SECTION 00 01 10.4

SECTION 00 01 01.5 TABLE OF CONTENTS: MEP ENGINEER

List of Specifications, As Prepared by:

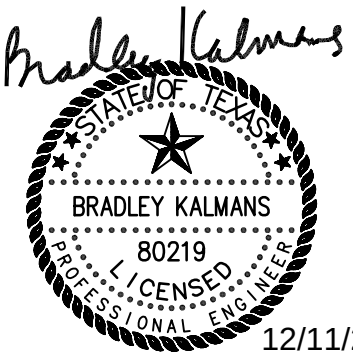
MEPT

SALAS O'BRIEN

10930 W. Sam Houston Pkwy N. Suite 900

HOUSTON, TX 77064

P: (866) 768-4625



12/11/2024

DIVISION 21	**FIRE PROTECTION**
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21 05 00	Fire Protection General Provisions
21 05 10	Fire Protection Contract Quality Control
21 05 12	Fire Protection Shop Drawings, Coordination Drawings & Product Data
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22 08 00	Plumbing Commissioning Coordination
22 11 16	Domestic Water Piping and Appurtenances
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END OF SECTION 00 01 10.5

SECTION 00 01 01.6 TABLE OF CONTENTS: TECHNOLOGY CONSULTANT

List of Specifications, As Prepared by:

MEPT

SALAS O'BRIEN

10930 W. Sam Houston Pkwy N. Suite 900

HOUSTON, TX 77064

P: (866) 768-4625

12/11/2024

DIVISION 27 COMMUNICATIONS

27 01 00	Operation and Maintenance (O&M) Manuals of Communications Systems
27 05 00	Communications Basic Materials, Methods and General Provisions
27 05 07	Communications Shop Drawings, Coordination Drawings & Product Data
27 05 09	Contract Quality Control
27 10 00	Structured Cabling System
27 51 23	IP Intercom System
27 51 24	Local Sound Distribution System
27 61 00	Integrated Audio-Video Systems and Equipment for Instructional Spaces
27 61 05	Audio Video Systems and Equipment

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28 01 00	Operation and Maintenance (O&M) Manuals of Electronic Safety and Security Systems
28 05 00	Electronic Safety and Security General Provisions
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28 05 10	Contract Quality Control
28 10 00	Electronic Access Control System
28 15 00	Intrusion Detection System
28 20 00	Video Surveillance System
28 46 00	Fire Detection and Alarm System
28 55 00	RF Survey for In-Building Emergency Responder Radio Coverage (ERRC) and Testing of Existing ERRC Enhancement Systems (EERCES)

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REQUEST FOR COMPETITIVE SEALED PROPOSALS

Competitive Sealed Proposals for the work identified below in accordance with Proposal Documents and addenda as may be issued prior to date of proposal opening will be received by the Board of Trustees, Lamar Consolidated Independent School District, until proposal closing date and time, as identified below. Proposals from Offerors will then be opened in public and read aloud.

OWNER:	Lamar Consolidated Independent School District 3911 Avenue I Rosenberg, Texas 77471 Phone: (832) 223 - 0250 Representative: Kevin McKeever
PROJECT:	Prototype #2 - Elementary School #38 522 Brookewater Blvd Rosenberg, TX 77471
EST. BUDGET:	$40,000,000.00
PREPROPOSAL CONFERENCE:	December 20, 2024, at 10:00 AM Location: Bond Program Office: 5015 Commodore Drive, Rosenberg, Texas77471 Representatives of the Architect, Owner will be present at this meeting. All proposers are encouraged to attend.
PROPOSAL DATE AND TIME:	January 21, 2025, at 2:00 PM – Base and Alternates Proposals
LOCATIONOF PROPOSALOPENING:	LCISD Service Center 4901 Avenue I, Rosenberg, Texas 77471
ARCHITECT:	Pfluger Architects 2 Greenway Plaza, Ste 460 Houston, Texas 77046 Phone: 713-222-1141

Complete Proposal Package (Drawings and Specifications) may be obtained from the Architect in electronic form via AutoDesk Docs by written/ email request to the following persons:

1. Diedra.Shaw@pflugerarchitects.com
2. Jazmin.Mendez@pflugerarchitects.com
3. Raleigh.Sullivan@pflugerarchitects.com

No hard copies will be provided, Offerors may print the proposal package at their own expense only for the purposes of preparing their respective proposals.

Office Hours are 8:00 AM to 5:00 PM

In addition, proposal documents can be reviewed at the following locations:

Virtual Builders Exchange
7035 W. Tidwell, Bldg J, Ste 112
Houston, Texas 77098
F: (832) 613-0344
www.virtualbx.com

ConstructConnect
(Formerly iSqFt & CMD)
Phone: (800) 364-2059

www.constructionconnect.com

Dodge Data & Analytics
4300 Beltway Pl, Suite 150, Arlington, TX 76018
(877) 784-9556
www.construction.com
https://dfmgr.construction.com/dfmgr/login

Submit Proposals to the Owner no later than the date and time specified. Submit proposals in duplicate in a sealed envelope in accordance with Section 00 20 00 Instructions to Offerors with the following information on the face of the envelope.

Name of Offeror (General Contractor)
Prototype #2 - Elementary School #38
Lamar Consolidated Independent School District
CSP #: 03-2025
Attn: Ms. Brandi Pittman, Director of Purchasing & Materials Management

The Owner reserves the right to reject any and all proposals and to waive any irregularities in the Competitive Sealed Proposal process.

No proposal shall be withdrawn within 45 days after the proposal opening without the specific consent of the Owner.

PROPOSAL BOND: A Proposal Bond (Section 00 40 01 Proposal Bond), from a bonding company acceptable to the Owner or a certified check in an amount equal to 10% of the greatest amount proposal shall accompany each Offeror's proposal.

PAYMENT BOND AND PERFORMANCE BOND: A Payment Bond and Performance Bond, each in an amount equal to 100% of the Contract Sum conditioned upon the faithful performance of the Contract will be required. Please note that all bonding companies presented must be acceptable to the Owner.

The prevailing rates of wages are the minimums that must be paid in compliance with applicable laws of the State of Texas.

Offerors submitting a proposal are encouraged to visit the site. All Offerors submitting a proposal are encouraged to attend the proposal opening.

Subcontractors and Suppliers intending to submit proposals to General Construction Offerors are required to prepare proposals based on a complete set of proposal documents.

Successful Subcontractors and Supplier Offerors must retain their Proposal Documents until completion of the construction.

Lamar Consolidated Independent School District (LCISD)

CSP #: 03-2025

RETURN THE FOLLOWING DOCUMENTS WITH BID/PROPOSAL PACKAGE:

From Section 00 11 00 Request for Competitive Sealed Proposals

1. Solicitation Cover Sheet
2. Response to Criteria Questions
3. Competitive Sealed Proposal Form
4. References (email to Architect, refer to Project Schedule for date)
5. Interested Party. Form 1295
6. Certificate of Residency
7. Felony Conviction Notification
8. Conflict of Interest Questionnaire
9. Certificate Regarding Lobbying
10. Vendor Debarment Statement
11. No Response Form – (*if choosing not to submit a response)*
12. Proposal Submission Form
13. Contractor Certification
14. Texas Statutory Performance Bond
15. Texas Statutory Payment Bond
16. Texas Government Code 2270 Verification Form

Refer to Section 00 20 00 Instructions to Offerors, for additional form requirements

Lamar Consolidated Independent School District (LCISD) Solicitation Cover Sheet

CSP #	**03-2025**
Due Date:	**January 21, 2025**

DUE NO LATER THAN 2:00 PM (CST)
LATE PROPOSALS WILL NOT BE ACCEPTED

Competitive Sealed Proposal (CSP): 03-2025
Prototype #2 - Elementary School #38

Company Name		
Company Address		
City	State	Zip
Taxpayer I.D. #		
Telephone	Fax	E-mail
Billing Address if different from above		
Authorized Representative Name		
Authorized Representative Signature		

Your signature attests to your offer to provide the goods and/or services in this solicitation according to the published provisions of this solicitation. Contract is not valid until LCISD Board has approved the award.

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

Competitive Sealed Proposal (CSP): Prototype #2 - Elementary School #38

Purpose of Solicitation	The intention of this solicitation is to solicit proposals to establish a contract to provide: **Prototype #2 - Elementary School #38** The estimated Project Budget for this project is $40,000,000.00.
Length of Solicitation	Single purchase instrument awarded with Lamar CISD Board approval.
Terms and Conditions	This solicitation shall be governed by the following documents which are incorporated herein. A copy may be obtained at http://www.lcisd.org/departments/business-office/purchasing/terms-and-conditions or by contacting the Lamar CISD Purchasing Dept. staff listed on the cover sheet. Any exception to the terms and conditions must be included in the Proposer's response. Texas Education Code 44.031 and Government Code 2269 Purchasing and Acquisition, LCISD Policy CH (Legal) Purchasing and Acquisition, LCISD Policy CH (Local) LCISD reserves the right to award this contract as best meets the district needs to waive informalities and to reject any or all proposals.
Response Requirements	LCISD will accept competitive sealed proposals either by mail or hand delivery until **January 21, 2025 at 2:00 PM (CST).** Please make certain that the Solicitation number is written clearly on the front of your envelope. Proposals received after the opening date and time will not be accepted and will be returned unopened. Submission Package must include: Two (2) Originals Please use the address below: **Lamar CISD Service Center** 4901 Avenue I, **Rosenberg, TX 77471** For additional information contact Brandi Pittman 832-223-0166 or by email at brandi.pittman@lcisd.org A response is required to all forms, questions and price entry listed on the Proposal Form. Leaving a line blank will be considered a "no bid" and may result in disqualification for your submission.

Prototype #2 - Elementary School #38

PROJECT SCHEDULE

Competitive Sealed Proposal (CSP): **CSP No.: 03-2025**

Release Construction Documents	December 16, 2024
Pre-Proposal Conference at 10:00 AM (CST) Location: Bond Program Office: 5015 Commodore Drive, Rosenberg, Texas77471	December 20, 2024 10:00AM
Submit Contractor Qualifications (A305) and References to Architect via email	January 12, 2025 (by 2:00 PM)
Receive Proposals at 2:00 PM (CST) Location: Lamar CISD Service Center 4901 Avenue I, Rosenberg, TX 77471	January 21, 2025
Award Construction Contract at LCISD Board Meeting	February 20, 2025
Contractor Start Date: (upon issuance of Notice to Proceed)	February 21, 2025
Substantial Completion Dates:	May 6, 2026

PROPOSAL EVALUATION CRITERIA

This proposal shall be evaluated using the evaluation criteria listed below.

	Evaluation Criteria	Point System
1	**Purchase price –** Proposal should offer a fair and reasonable price for services to be procured by Lamar CISD. Pricing will be calculated using the Price Delivery Sheet in this document.	40
2	**Reputation of the vendor and of the vendor's goods or services –** Proposer should have a solid reputation with other ISDs, government or collegiate entities that shows a high level of customer service and a high level of quality of goods or services. References will be contacted via e-mail.	10
3	**Quality of the vendor's goods or services –** Overall assessment of vendor's **s**ervices. Vendor will be expected to meet schedules and operate with minimal disruption in accordance with the outlined specifications.	10
4	**Extent to which the goods or services meet the district's needs** Assessment of Submitted Project Plan and Schedules	10
5	**Vendor's past relationship with the district** 8-10: Good business with LCISD, staff recommends use again 5-7: Good business with no documented issues **OR** never performed business with LCISD but has experience with other school districts or government entities. 1-4: Past performance was documented as being poor**.**	10
6	**Proposed team offers experience and knowledge base required for the project** • Organizational chart of proposed project team • Resume of each proposed team member	10
7	**Ability to provide proper bonds and insurance requirements –** Provide proof of proper insurance and bonding capacity.	5
8	**Safety Record** Vendor must submit copy of Experience Modifier Rate (EMR) for the last three years. The totals for the three years are calculated and averaged to receive the points below. 10 - EMR of .50 or less 8 - EMR 0.51-0.85 6 - EMR 0.86-0.99 4 - EMR greater than 1.0 2 - EMR not included	5
9	**Total**	**100**

PROPOSSAL EVALUATION CRITERIA NOTES:

Careful consideration should be given to all items of the above Evaluation Criteria table. The points awarded to each item will be based on **how well each submission:**

1. Provides thoroughly developed, competitive pricing using the tables in Pricing Delivery Information of this CSP.

2. Provides evidence of experience in general and the ability to perform services to a district similar to Lamar CISD and names & contact information for references.

3. Provides evidence related to the quality of services, as well as the results of references provided by each respondent.

4. Provides an effective plan and schedule that addresses the scope presented in therequest for proposals.

5. Provide list of history of projects with Lamar CISD.

6. Provides information describing experience and qualifications of onsite leadership and key staff to be assigned to the contracted work.

7. Provides an adequate and current certificate of insurance coverage.

8. Provides evidence of participation in an OSHA compliant safety program and any other safety policies in place.

PROVIDE RESPONSE TO EACH OF THESE CRITERIA QUESTIONS IN YOUR BID/ PROPOSAL PACKAGE.

PRICE DELIVERY INFORMATION
COMPETITIVE SEALED PROPOSAL FORM
Prototype #2 - Elementary School #38
(CSP): 03-2025
LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

Submitted by: _____

Date:_____Phone No.: _____

To: Board of Trustees
Lamar Consolidated Independent School District
3911 Avenue I
Rosenberg, TX 77471

Having examined the Lamar CISD Purchasing Department's Proposal Documents, the Contract Documents prepared by Pfluger Architects, dated **December 12, 2024**, and having examined site conditions, the undersigned proposes to furnish all labor, equipment and materials and perform all work for the completion of the above- named project for the sum indicated below.

In submitting his Proposal, the undersigned agrees to the following:

1. Hold proposal open for acceptance 60 days.
2. Accept right of Owner to reject any or all proposals, to waive formalities and to accept proposal which Owner considers most advantageous.
3. Enter into and execute the contract, if awarded, for the Base Proposal.
4. Complete work in accordance with the Contract Documents within the stipulated contract time.
5. By submission of this Proposal, the undersigned affirms that, to the best of his knowledge, the Proposals have been arrived at independently and is submitted without collusion with anyone to obtain information or gain any favoritism that would in any way limit competition or give an unfair advantage over respondents in the award of this proposal.
6. By submission of this Proposal the undersigned agrees to all provisions summarized in the Lamar CISD Terms & Conditions and that his Proposal has been prepared in accordance with the Instructions given in this section.

I. BASE PROPOSAL

Prototype #2 - Elementary School #38

Undersigned agrees to complete the Work for the lump sum amount of:

_____Dollars $_____
(Amount written in words governs) (Amount in figures)

II. ALTERNATES

1. **Alternate No 1:** If Brookewater Blvd. is not completed by the time the school's construction is finished, provide construction and future demolition of temporary connectors from Wallingford Park Drive. This shall include all necessary work to complete the final roads and surrounding landscape fully and any additional work required for complete finalization.

[Add or Deduct] the sum of
_____*and* _____*/100 DOLLARS*
($_____) to the Base Proposal.

2. **Alternate No 2:** If Brookewater Blvd. is not completed by the time the school construction is finished, please provide for the construction and future demolition of a temporary rainstorm outfall that will connect to the detention area across Brookewater Blvd. This should include all necessary final connections to the permanent outfalls and any additional work required for complete finalization.

[Add or Deduct] the sum of
_____and _____/100 DOLLARS
($_____) to the Base Proposal.

III. ALLOWANCES

Undersigned certifies that the allowances listed below and specified in Section 01 21 00 are **included in the corresponding Base Proposal above** and agrees that the unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

A. Owner's Contingency Allowance – Prototype #2 - ES #38 $350,000.00

B. Network Equipment & Phone Allowance – Prototype #2 - ES #38 $750,000.00

C. Cameras Only Allowance – Prototype #2 - ES #38 $200,000.00
Provide camera equipment, installation, and integration. Cabling is included in the project.

D. Access Control Allowance – Prototype #2 - ES #38 $100,000.00
Provide equipment, installation, and integration, for head-in equipment in IDF's.
Hardware is included in Division 8 of the project.

E. Utility Infrastructure Allowance – Prototype #2 - ES #38 $30,000.00

F. Building Controls Allowance – Prototype #2 - ES #38 $550,000.00

G. Supergraphics Allowance – Prototype #2 - ES #38 $80,000.00

H. Static pressure pumps Allowance - Prototype #2 – ES #38 $300,000.00

IV. UNIT PRICES

A. Unit Price 1: Electrical Outlet

Dollars $

(Amount written in words governs amount written in figures)

B. Unit Price 2: Data Outlet

Dollars $

(Amount written in words governs amount written in figures)

C. Unit Price 3: Cubic Yard of Concrete

Dollars $

(Amount written in words governs amount written in figures)

D. Unit Price 4: Square Yard of Asphalt

Dollars $

(Amount written in words governs amount written in figures)

E. Unit Price 5: Square Foot of Sidewalk (based on profile)

Dollars $

(Amount written in words governs amount written in figures)

F. Unit Price 6: Chain Link Fencing

Dollars $

(Amount written in words governs amount written in figures)

G. Unit Price 7: Ornamental Fencing

Dollars $

(Amount written in words governs amount written in figures)

CONTRACT TIME

The undersigned agrees that he has included all labor and materials to be substantially complete with the work defined by these contract documents. The Offeror attests and affirms that his proposal includes all necessary costs associated with overtime to substantially complete the work by the following date. The number of days to be anticipated as delay days shall be included as specified in Document 00 73 00 – LCISD Supplementary Conditions to the Contract for Construction and managed by the Project Team in accordance with this section and as otherwise stated in the Project Manual.

Undersigned agrees to begin Work upon Notice to Proceed and be Substantially Complete by **the dates for each scope of work.**

V. ADDENDA

Undersigned acknowledges receipt of Addenda Nos._____, _____, _____, _____, _____.

VI. CHANGES IN THE WORK

Undersigned understands that changes in the work shall be performed in accordance with the Supplementary Conditions.

VII. LIQUIDATED DAMAGES

Undersigned understands that liquidated damages as defined in the Supplementary Conditions will be included in the form of Agreement between Owner and Contractor and that the contractor will be bound thereto.

VIII. PROPOSED CONSTRUCTION SCHEDULE

Attach a preliminary construction schedule for use in evaluating the Offeror's proposal.

It is understood that the right is reserved by the Owner to reject any or all proposals or waive any informalities in the proposal process.

_____
Authorized Signature

_____
Title

(Seal, if a Corporation)
State whether Corporation,
Partnership or Individual

_____
Name of Contracting Firm

_____
Address

_____

_____
Telephone

_____
Date

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

REFERENCES

Please provide at least four (4) school district (campus) references that have used your company for the same goods Lamar CISD is requesting in this proposal. Please include contact name, school district, address, telephone number, and e-mail address.

A valid e-mail address is required. Please make sure the e-mail address is legible and current.

COMPANY NAME
ADDRESS
EMAIL
PHONE NO.

COMPANY NAME
ADDRESS
EMAIL
PHONE NO.

COMPANY NAME
ADDRESS
EMAIL
PHONE NO.

COMPANY NAME
ADDRESS
EMAIL
PHONE NO.

RETURN THIS DOCUMENT TO ARCHITECT VIA EMAIL

LAMAR CISD CERTIFICATE OF INTERESTED PARTIES – FORM 1295

Certificate of Interested Parties (Form 1295 – must be filled out electronically with the Texas Ethics Commission's online filing application, printed out, signed, notarized, and submitted with proposals or qualifications to Lamar CISD.

Lamar CISD is required to comply with House Bill 1295, which amended the Texas Government Code by adding Section 2252.908, Disclosure of Interested Parties. Section 2252.908 prohibits Lamar CISD from entering into a contract resulting from this solicitation with a business entity unless the business entity submits a Disclosure of Interested Parties (Form 1295) to Lamar CISD at the time business entity submits the signed contract/proposal/qualifications. The Texas Ethics Commission has adopted rules requiring the business entity to file Form 1295 electronically with the Texas Ethics Commission.

"Interested Party" means a person:

a) who has a controlling interest in a business entity with whom Lamar CISD contracts; or
b) who actively participates in facilitating the contract or negotiating the terms of the contract, including a broker, intermediary, adviser, or attorney for the business entity.

"Business Entity" means an entity recognized by law through which business is conducted, including a sole proprietorship, partnership, or corporation.

As a "business entity," all vendors must electronically complete, print, sign, notarize, and submit Form 1295 with their proposals even if no interested parties exist.

Proposers must file Form 1295 electronically with the Texas Ethics Commission using the online filing application, which can be found at https://www.ethics.state.tx.us/whatsnew/elf_info_form1295.htm. Proposers must use the filing application on the Texas Ethics Commission's website to enter the required information on Form 1295. Proposers must print a copy of the completed form, which will include a certification of filing containing a unique certification number. The Form 1295 must be signed by an authorized agent of the business entity, and the form must be notarized.

The completed Form 1295 with the certification of filing must be filed with Lamar CISD by attaching the completed form to the vendor's proposal.

Lamar CISD must acknowledge the receipt of the filed Form 1295 by notifying the Texas Ethics Commission of the receipt of the filed Form 1295 no later than the 30th day after the date the contract binds all parties to the contract. After Lamar CISD acknowledges the Form 1295, the Texas Ethics Commission will post the completed Form 1295 to its website with seven business days after receiving notice from Lamar CISD.

I have read and understand the above information regarding the Certificate of Interested Parties Form 1295. I understand the action needed on my part as an interested party. **I also understand that the 1295 filing form shall be returned with RFP response.**

Acknowledgement Signature: _____

Printed Name: _____

Date: _____

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

CERTIFICATE OF RESIDENCY

The State of Texas has passed a law concerning non-resident contractors. This law can be found in Texas Education Code under Chapter 2252, Subchapter A. This law makes it necessary for LCISD to determine the residency of its proposers. In part, this law reads as follows:

"Section: 2252.001

(3) 'Non-resident bidder' refers to a person who is not a resident.

(4) 'Resident bidder' refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Section: 2252.002

A governmental entity may not award a governmental contract to a nonresident bidder unless the nonresident underbids the lowest bid submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located."

I certify that _____
(Name of Company)

is, under Section: 2252.001 (3) and (4), a

☐ Resident Bidder

☐ Non-resident Bidder

My or Our principal place of business under Section: 2252.001 (3) and (4), is in the city of

_____ in the state of _____

_____
Signature of Authorized Company Representative

_____
Print Name

_____ _____
Title Date

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

FELONY CONVICTION NOTIFICATION

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History, Subsection (a), states "a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony".

Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The District must compensate the person or business entity for services performed before the termination of the contract".

This notice is not required of a Publicly-Held Corporation.

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony convictions has been reviewed by me and the following information furnished is true to the best of my knowledge.

Vendor's Name:_____

Authorized Company Official's Name (Printed):_____

Check one of the following and sign as appropriate.

☐ My firm is a publicly held corporation; therefore, this reporting requirement is not applicable.

Signature of Company Official:_____

☐ My firm is not owned or operated by anyone who has been convicted of a felony.

Signature of Company Official:_____

☐ My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:

Name of Felon(s): _____

Details of Conviction(s): _____

Signature of Company Official:_____

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

CONFLICT OF INTEREST QUESTIONNAIRE

PLEASE COMPLETE AND SIGN EVEN IF NO CONFLICT EXISTS

For vendor or other person doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 1491, 80th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code by a person who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the person meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the person becomes aware of facts that require the statement to be filed. *See* Section 176.006, Local Government Code.

A person commits an offense if the person knowingly violates Section 176.006, Local Government Code. An offense under this section is a Class C misdemeanor.

OFFICE USE ONLY

Date Received

Name of person and company who has a business relationship with local governmental entity.

☐ **Check this box if you are filing an update to a previously filed questionnaire.**

(The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date the originally filed questionnaire becomes incomplete or inaccurate.)

Please enter name of local government officer with whom filer has employment or business relationship.

_____

This section (item 3 including subparts A, B, C & D) must be completed for each officer with whom the filer has an employment or other business relationship as defined by Section 176.001(1-a), Local Government Code. Attach additional pages to this Form CIQ as necessary.

A. Is the local government officer named in this section receiving or likely to receive taxable income, other than investment income, from the filer of the questionnaire?

☐ Yes ☐ No

B. Is the filer of the questionnaire receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer named in this section AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

C. Is the filer of this questionnaire employed by a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership of 10 percent ormore?

☐ Yes ☐ No

D. Describe each employment or business relationship with the local government officer named in thissection.

_____

_____ _____

Signature of person doing business with the governmental entity Date

_____

Name of Business/Company

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

CERTIFICATION REGARDING LOBBYING
CERTIFICATION FOR CONTRACTS, GRANTS, LOANS, AND COOPERATIVE AGREEMENTS

The undersigned certifies, to the best of his or her knowledge and belief, that:

1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of a Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying”, in accordance with its instruction.

3) The undersigned shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including subcontracts, sub grants and contracts under grants, loans, and cooperative agreements) and that all sub recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, US Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____ _____

Company Authorized Representative (Print)

_____ _____

Signature Date

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

VENDOR DEBARMENT STATEMENT

I have read the conditions and specifications provided in the bid document attached.

I affirm, to the best of my knowledge, the company I represent has not been debarred or suspended from conducting business with school districts in the State of Texas. This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, 7 CFR Part 3017, Section 3017.510, Participants' responsibilities. The regulations were published as Part IV of the January 30, 1989, Federal Register (pages 4722-4733). Copies of the regulation may be obtained by contacting the Department of Agriculture Agency with which this transaction originated.

_____
NAME OF COMPANY (Please Type)

_____
MAILING ADDRESS CITY STATE ZIP

_____
PREPARED BY (Please Type)

_____ _____
SIGNATURE TITLE

_____ _____
TELEPHONE NUMBER FAX NUMBER DATE

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

NO RESPONSE FORM

RETURN ONLY IF YOU CHOOSE NOT TO SUBMIT A RESPONSE TO THIS SOLICITATION

YOU MAY EMAIL THIS FORM TO ARCHITECT

Competitive Sealed Proposal CSP: 03-2025
Prototype #2 - Elementary School #38

Whereas on the_____day of_____, 2022.

Name of company

has reviewed LCISD's CSP # **03-2025** and elects not to submit a bid:

State Reason for no bid:

Street Address

City	State	Zip

Telephone/Fax Number

Name of Authorized Individual

Signature of Authorized Individual

PROPOSAL SUBMISSION FORM

Competitive Sealed Proposal CSP: 03-2025
Prototype #2 - Elementary School #38

Please Print

Whereas on the_____day of_____, 20____(print name of company)

_____ has reviewed

Solicitation No. **CSP 03-2025 and** has responded in accordance with the terms and conditions which are incorporated herein.

A copy may be obtained at http://www.lcisd.org/departments/business-office/purchasing/terms-and-conditions or by contacting the LCISD Purchasing staff person listed on the cover sheet. Any exception to the terms and conditions must be included in the Proposer's response.

Texas Education Code 44.031 and Government Code 2269
Purchasing and Acquisition, LCISD Policy CH (Legal)
Purchasing and Acquisition, LCISD Policy CH (Local)

_____	_____
Street Address	City, State, Zip Code
_____	_____
Telephone Number	Fax Number
_____	_____
Name of Authorized Individual	Signature of Authorized Individual

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

Contractor Certification

Introduction: Texas Education Code Chapter 22 requires entities that contract with school districts to obtain criminal history records on covered employees. Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Contractors must certify to the district that they have complied and must obtain similar certifications from their subcontractors.

Definitions:
Covered individuals: Individual who have or will have continuing duties related to the service to be performed and have or will have direct contact with students. The District will be the final arbiter of what constitutes direct contact with students.

Disqualifying criminal history: (1) a conviction or other criminal history information designated by the District; (2) a felony or misdemeanor offense that would prevent a person from obtaining certification as an educator under Texas Education Code § 21.060, including 19 Tex. Admin. Code §249.16; or (3) one of the following offenses, if at the time of the offense, the victim was under 18 or enrolled in a public school: (a) a felony offense under Title 5, Texas Penal Code; (b) an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or (c) an equivalent offense under federal law or the laws of another state.

On behalf of _____("Contractor"), I certify that check one:

☐ None of Contractor's employees are *covered individuals*, as defined above. If this box is checked, I further certify that Contractor has taken precautions or imposed conditions to ensure that Contractor's employees will not become *covered individuals*. Contractor will maintain these precautions or conditions throughout the time the contracted services are provided.

Or

☐ Some or all of Contractor's employees are *covered individuals*. If this box is checked, I further certify that:

1. Contractor has obtained all required criminal history record information regarding its covered individuals. None of the covered individuals has a disqualifying criminal history.
2. If Contractor receives information that a covered individual subsequently has a reported criminal history, Contractor will immediately remove the covered individual from contract duties and notify the District in writing within three business days.
3. Upon request, Contractor will provide the District with the name and any other requested information of covered individuals so that the District may obtain criminal history record information on the covered individuals.
4. If the District objects to the assignment of a covered individual on the basis of the covered individual's criminal history record information, Contractor agrees to discontinue using the covered individual to provide services at the District.

Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

_____ _____
Signature Date

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

LAMAR CISD INSURANCE REQUIREMENTS

Contractor shall maintain insurance coverage in the amounts specified in Section 00 73 00 A201 LCISD Supplementary Conditions. and furnish to District. If any work provided for or to be performed under any Specifications is sub-let (as otherwise permitted by the terms of such Specifications), the contractor shall require the subcontractor to maintain and furnish him with satisfactory evidence of *Workers* Compensation, Employer's Liability and such other forms and amounts of insurance which the contractor deems reasonably adequate. Certificates of Insurance on the current ACORD form shall be issued to District showing all required insurance coverage.

Insurance Conditions

All insurance coverage shall be issued on an Occurrence basis (except Professional Liability) by companies acceptable to District and licensed to do business in the State of Texas by the Texas Department of Insurance. Such companies shall have a Best's Key rating of at least "A- X".

All certificates must include:

1. The location or description and the bid number, CSP number or Purchase Order number
2. A 60-day notice of cancellation of any non-renewal, cancellation or material change to any of the policies
3. "Additional Insured" on the Property, General Liability, Automobile Liability and Umbrella (Excess) Liability policies naming the District.
4. A "Waiver of Subrogation" clause in favor of the District will be attached to the Workers Compensation, General Liability, Automobile Liability, Umbrella Liability and the Property insurance policies.
5. In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the District as Additional Insured, and (b) showing waivers of subrogation in favor of the District: CG2010, CG2037, CG2404, CA0070, CA0032, WC0003 or their equivalents.

All insurance must be maintained for one year following substantial completion with Certificates of Insurance provided.

Contractor shall be responsible for payment of all deductibles; the District shall approve the deductibles selected.

If any policy has aggregate limits, a statement of claims against the aggregate limits is required.

The District reserves the right to review the insurance requirements during the effective period of any contract to make reasonable adjustments to insurance coverage and limits when deemed reasonably prudent by District based upon changes in statutory laws, court decisions or potential increase in exposure to loss.

Lamar CISD – Purchasing Dept.
4911 Avenue I,
Rosenberg, TX 77471

TEXAS STATUTORY PERFORMANCE BOND

Bond No.: _____

(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that:_____
(hereinafter called the Principal), as principal, and _____
a corporation organized and existing under the laws of the State of _____
authorized and admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter called the Surety), as Surety, are held and firmly bound unto

_____

(hereinafter called the Obligee) in the amount of _____

_____

Dollars($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ day of_____, 20_, for

Prototype #2 - Elementary School #38
LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas Government Code and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____day of_____, 20__.

_____ (Seal)
Principal

_____ By:_____(Seal)
Surety Address

_____ (Seal)
Surety

_____
Surety Telephone Number

By: _____
Attorney-in-Fact

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

TEXAS STATUTORY PAYMENT BOND

Bond No.: _____

(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that:

_____

(hereinafter called the Principal), as principal, and _____
a corporation organized and existing under the laws of the State of _____
authorized and admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety (hereinafter called the Surety), as Surety, are held and firmly bound unto

_____

(hereinafter called the Obligee) in the amount of _____

_____

Dollars($_____) for the payment whereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ day of_____, 20_, for

Prototype #2 - Elementary School #38
LAMAR CONSOLIDATED INDEPENDENT SCHOOL DISTRICT

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas Government Code and all liabilities on this bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this _____day of_____, 20_.

_____ (Seal)
Witness: Principal

_____ By:_____(Seal)

Witness: _____(Seal)
_____ Surety

By: _____
Attorney-in-Fact

_____

_____ _____
Surety Address Surety Telephone Number

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

Certification Regarding Terrorist Organizations and Boycott of Israel

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law.

Contractor hereby certifies and verifies that neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

(Continued next page)

Texas Government Code 2270 Verification Form

Texas 2017 House Bill 89 has been signed into law by the governor and as of September 1, 2017 will become law codified as Texas Government Code § 2270 and 808 et seq.

The relevant section addressed by this form reads as follows:
Texas Government Code Sec. 2270.002. PROVISION REQUIRED IN CONTRACT. A governmental entity may not enter into a contract with a company for goods or services unless the contract contains a written verification from the company that it: (1) does not boycott Israel; and (2) will not boycott Israel during the term of the contract.

I,_____as an authorized representative of

_____, a contractor engaged by
Insert Name of Company

_____
Insert Name of Texas Governmental Entity

,
Address of Texas Governmental Entity

verify by this writing that the above-named company affirms that it (1) does not boycott Israel; and (2) will not boycott Israel during the term of this contract, or any contract with the above- named Texas governmental entity in the future. I further affirm that if our company's position on this issue is reversed and this affirmation is no longer valid, that the above-named Texas governmental entity will be notified in writing within one (1) business day and we understand that our company's failure to affirm and comply with the requirements of Texas Government Code 2270 et seq. shall be grounds for immediate contract termination without penalty to the above-named Texas governmental entity.

I swear and affirm that the above is true and correct.

_____ _____
Signature of Named Authorized Company Representative Date

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

END OF SECTION 00 11 00

SECTION 00 20 00
INSTRUCTIONS TO OFFERORS

1.01 QUALIFIED OFFERORS

A. Competitive Sealed Proposals will be accepted from qualified Offerors (General Contractors) only for the entire scope of work described in the Contract Documents. As a prerequisite to an Offeror's qualifying for the award of contract on this work, the Offeror must complete each item of the Contractor's Qualification Statement (AIA Document A305). The Statement forms may be obtained from the Houston Chapter of the American Institute of Architects, 315 Capitol, Suite 120, Houston, Texas 77002, (713) 520-0155. In addition to the information contained in the Statement form, offerors shall also address the selection criteria issues listed under the paragraph below for Determination of Successful Respondent and Award of Contract. **Submit to Architect via email**

B. The primary purposes of the evaluation process will be to:
   1. Gather information for the Owner's evaluation procedure.
   2. Enable the Owner and/or Architect to evaluate the Offeror's qualifications.

C. After review of Proposals and Contractor's qualifications evaluation the Owner will make his decision and each Offeror will be notified.

D. In arriving at his opinion concerning the Offeror's qualifications, the Architect will use the same criteria that the Owner will use in determination of the successful Offeror as detailed hereinafter.

E. In the event a proposed Offeror fails to submit the specified Contractor's Qualification Statement at time of receipt for Proposals, such noncompliance shall be considered by both the Owner and Architect as a negative factor in the determination of the successful Offeror.

1.02 OFFEROR'S PRESENTATION

A. Each Offeror by making his Proposal represents that:
   1. He has read and understands the Proposal Documents and his Proposal is made in accordance therewith.
   2. He has thoroughly familiarized themselves with Division 01 General Requirements as they are applicable to subsequent specification sections.
   3. He has visited the site, has familiarized himself with the local conditions under which the work is to be performed and has correlated his observations with the requirements of the proposed Contract Documents.
   4. He agrees to comply with the requirements of the following paragraph. Any Offeror who subsequently does not agree to comply with these requirements will automatically disqualify himself from proposing or receiving award of the contract.

B. He agrees that:
   1. Work on the project will begin immediately upon receipt of signed Contract or Notice to Proceed.
   2. Offeror will participate as a team member in cooperation with the Project Architect, Engineers, Owner, and Owners agents and/or consultants.
   3. The Offeror will assign a competent full-time superintendent, to the project, and that superintendent shall be maintained on the project for the duration of the project, subject only to his continuous employment.
   4. The Offeror will furnish and pay for a proposal bond in the amount of ten percent (10%) of the contract amount.
   5. If awarded, the Offeror shall furnish and pay for a Performance Bond and a Payment Bond each in the full contract amount.

6. Offeror shall carry and keep in full force for the duration of the Project, insurance coverage for builder's risk, workmen's compensation, comprehensive general liability, and automobile liability as required by the General Conditions and/or Supplementary General Conditions of the Specifications.
7. Each Offeror by making his Proposal represents that his Proposal includes only material and equipment specified in the Proposal Documents and supplemented, if necessary, for a complete and operating system.
8. Where subcontract work is involved and where Acceptable Subcontractors are designated for particular sections or phases of the Work, each Offeror by making his Proposal represents that his Proposal includes only firms designated as Acceptable Subcontractors.
9. That no asbestos PCBs or lead building materials shall be used, and that each Offeror (and sub-offeror or supplier submitting a proposal to an Offeror) shall submit an affidavit at Project Close-out stating that no asbestos, PCB's or lead building materials has been used on the Project.

1.03 PROPOSAL DOCUMENTS

A. Proposal Documents include the Competitive Sealed Proposal, Noticed Package, Instructions to Offerors, and the proposed Contract Documents, including any Addenda issued prior to receipt of proposals.

B. Contract Documents for the work consist of the Owner-Contractor Agreement, the Conditions of the Contract (General, Supplementary and other Conditions), the Drawings, the Specifications, and all Addenda issued prior to receipt of proposals.

1.04 PROPOSAL PROCEDURES

A. A proposal is invalid if it has not been received at the designated location prior to the time and date for receipt of proposals indicated in the Request for Competitive Sealed Proposals, or prior to any extension thereof issued to the Offerors by Addenda.

B. All requested Alternates shall be proposed. If no change in the Base Proposal is required, enter "No Change".

C. Prior to the receipt of Proposals, Addenda will be forwarded by the Architect and will be available for inspection wherever the proposal documents are kept available for that purpose.

Proposals will be received in duplicate only on the Owner's Form of Proposal for the work as indicated by the Proposal Documents, filled in, and enclosed in a sealed envelope addressed as follows:

Name of Offeror (General Contractor)
Prototype #2 - Elementary School #38
Lamar Consolidated
Independent School District
CSP # 03-2025
Attn: Ms. Brandi Pittman, Director of Purchasing & Materials Management

E. The Proposal Bond Form (attached to section 00 40 01), must be accompanied by Proposal Bond or Certified Check in the amount of 10% of the proposal.

F. All proposals must be delivered sealed to the following address at or before the time and date set. Proposals will be received at no other place. If Proposal is sent by U.S. Mail, it must be sent Registered Mail.

LCISD Service Center
4901 Avenue I,
Rosenberg, Texas 77471

G. A proposal may be withdrawn only upon request by the Offeror or his duly authorized representative, provided such request is received by the Owner at the place designated for receipt of proposals and prior to the time fixed for the opening of proposals. A withdrawal of a proposal shall not be effective unless a written confirmation of the withdrawal is received by the Owner at said place within 48 hours before the time fixed for the opening of proposals. The Proposal Bond will be returned with the proposals if withdrawn in accordance with the above. The withdrawal of a proposal does not prejudice the right of the Offeror to file a new proposal at the time and place stated. No proposal may be withdrawn after the time fixed for the opening of proposals for a period of 30 days.

1.05 INTERPRETATION OF PROPOSAL DOCUMENTS

A. Offerors and sub-offerors requiring clarification or interpretation of the Proposal Documents shall make a written or verbal request which shall reach the Architect at least ten (10) days prior to the date for receipt of proposals.

B. Any interpretation, correction or change of the Proposal Documents will be made by Addendum. Interpretations, corrections, or changes of the Proposal Documents made in any other manner will not be binding.

1.06 SUBSTITUTIONS OF MATERIALS AND EQUIPMENT

A. The materials, products and equipment described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an addendum as a substitution prior to the submission of proposals.

B. No substitution will be considered prior to receipt of proposals unless written request for approval has been received by the Architect at least seven (7) days prior to the date for receipt of proposals as described in Section 01 25 00 – Products Substitution Procedures. Each such request shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitute including drawings, cuts, performance and test data and any other information necessary for an evaluation. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

C. If the Architect approves any proposed substitution prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

D. No substitutions will be considered after the Contract award.

1.07 REJECTION OF PROPOSALS

A. The Owner shall have the right to reject any or all proposals and to reject a proposal not accompanied by any required proposal security, or by other data required by the Proposal Documents, or to reject a proposal which is in any way incomplete or irregular.

B. The Owner reserves the right to reject any or all proposals and to waive any formalities or irregularities and to make the award of the contract in the best interest of the Owner.

C. The Owner reserves the right to reject any proposal if the evidence submitted by, or investigation of, such offeror fails to satisfy the Owner that such offeror is properly qualified to carry out the obligations of the contract and to complete the work therein. Award may be made to other than the low- dollar offeror and given the one offering the "best value" to the school district, in addition to the purchase price, based on the published selection criteria and on its ranking evaluation.

D. Do not submit voluntary alternates. The Owner reserves the right to reject any proposal which is accompanied by conditional or qualifying statements, or "voluntary alternates".

1.08 INSURANCE

A. Each Offeror shall include in his proposal the complete cost and shall carry and keep in full force for the duration of the project, insurance coverage required under the General Conditions and Document 00 73 00 – LCISD Supplementary Conditions.

1.09 PERFORMANCE BOND AND PAYMENT BOND

A. Each Offeror shall include in this proposal the premium costs for 100% Performance Bond and 100% Payment Bond. These bonds shall cover the faithful performance of the contract and payment of all obligations arising thereunder in such form as the Owner may prescribe. The bonding companies must be acceptable to the Owner. The selected Offeror shall deliver the required bonds to the Owner not later than the date of execution of the Contract.

1.10 PROPOSAL SECURITY

A. No proposal will be considered unless it is accompanied by a Certified or Cashier's Check or Proposal Bond executed on the Proposal Bond Form (attached to Section 00 40 01) In either case the amount shall be not less than ten percent (10%) of the greatest amount proposed (considering alternates, if any). The proposal security shall insure the execution of the contract and the furnishing of an acceptable Performance Bond and Payment Bond by the successful Offeror within ten (10) days after notification of award to such Offeror and that this proposal will not be withdrawn within 30 days after date of opening of proposals without the consent of the Owner. Proposal Bond shall be prepared in the identical form of AIA Document A310 or the form attached.

1.11 SUBMISSION OF POST PROPOSAL INFORMATION

A. The apparent Selected Offeror shall within three (3) days after proposals are received submit the following:
   1. A designation of the work to be performed by the Offeror with his own forces.
   2. An experience profile of the selected Offeror's superintendent scheduled to work on this project. In addition, the apparent selected Offeror shall cooperate with the Owner, supplying requested information to substantiate the qualifications of the superintendent. If, in the opinion of the Owner, the superintendent does not qualify, the Owner may request the submission of another superintendent and more information. The Owner reserves the right to reject the apparent selected Offeror if an acceptable superintendent is not presented.

B. The Selected Offeror shall within five (5) days thereafter submit the following:

   1. A statement of costs for each major item of work included in the proposal as described in Section 01 29 00 – Payment Procedures. Each section of specifications will be considered a major item of work and shall be shown as a separate cost item.

1.12 AWARD OF CONTRACT

A. The Offeror to whom the award is made will be promptly notified. If an Offeror (a) withdraws his proposal within 60 days after the date of time fixed for the opening of proposals in the Request for Competitive Sealed Proposals, or (b) fails or refuses to execute the Agreement, or other required forms within ten (10) days after the same are presented to him for signature, or (c) fails or refuses to

furnish properly executed Performance Bond and Certification of Required Insurance within 15 calendar days of execution date of the Agreement, the Owner may award the work to another Offeror or Offerors or may call for new proposals.

B. The Offeror will be required to (a) submit his Proposal and Proposal Bond, (b) execute Contract and Performance and Payment Bonds, and (c) submit Certification of required insurances, all using the Owner's own forms for such respective purposes.

C. Proposal Bond is forfeited if proposal is withdrawn after the proposal opening, or Contract Documents are not executed in accordance with the above.

1.13 NOTICE TO PROCEED

A. The Offeror shall not commence work under this Contract until he receives the written Notice to Proceed, or the Contract is duly signed by the Owner.

1.14 COMPLETION TIME

A. Offerors shall familiarize themselves with the Owners requirements concerning the project schedule as described in Section 01 32 16 of this Project Manual. **There will be no extension of time due to weather.**

B. Having thoroughly familiarized himself with the conditions as they exist at the building sites and acquainted himself with the labor supply and the material market, the Offeror will state in his proposal that he agrees to be substantially complete with the work by the date stated above.

C. It is therefore expressly agreed as a part of the consideration inducing the Owner to execute this contract that the Owner may deduct liquidated damages from the final payment made to the Contractor for each and every calendar day beyond the agreed date which the Contractor shall require for Substantial Completion of the work included in this contract. It is expressly understood that the said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the work is not completed within the agreed time, or within the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty, said damage being caused by additional compensation to personnel, for loss of interest on money and other miscellaneous increased costs, all of which are difficult of exact ascertainment. Also, any disruption of Owner's use of the existing facilities or newly completed facilities will also be subject to liquidated damages. Refer to Section 01 32 00 for additional requirements. Delays, disruption of use, failures to complete, and liquidated damages are fully described under Article 8.3 of the Supplementary Conditions.

The definition of Substantial Completion is found in Article 9.8.1 of the AIA General Conditions and Supplementary Conditions bound herein.

1.15 FELONY CONVICTION NOTIFICATION

A. Section 44.034, of the Texas Education Code requires a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of a felony. The notice must include a general description of the conduct resulting in the conviction of a felony. Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract." Subsection (c) states "this section does not apply to a publicly held corporation."

1.16 AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

A. The Offeror, and sub-offerors, shall agree to refrain from discrimination in terms and conditions of employment to the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and Rules and Regulations issued in order to maintain and insure non-discriminatory employment practices.

B. The Offerors **must** execute, Affidavit of Non-Discriminatory Employment (attached to Section 00 40 13) and submit with Proposal. The sub-offerors shall execute, Affidavit of Non-Discriminatory Employment (attached to Section 00 40 13) before commencing work on this Project. Offerors and sub-offerors who have not executed this document will not be eligible to work on this project.

1.17 LIST OF SUBCONTRACTORS

A. The Offeror shall supply a list of their subcontractors.

B. The Offeror **must** execute, List of Subcontractors (attached to Section 00 40 12) and submit **24 hours after submission of Proposal to Architect via email**.

1.18 AFFIDAVIT OF NON-ASBESTOS, LEAD, AND PCB USE IN PROJECT

A. The use of any construction process or the installation of any asbestos, lead and PCBs or material containing asbestos, lead and PCBs is strictly prohibited for this Project.

B. Prior to submitting a proposal, Offerors shall notify the Architect, in writing, of any materials in these specifications which are known to contain or are likely to contain asbestos, lead or PCBs.

C. The Offeror, and sub-offerors shall agree to refrain from using products which are known to contain asbestos, lead, and PCB containing materials as applicable to the project. They shall also affirm that lead or lead bearing materials have not been incorporated into potable water systems, and that lead sheet flashing used in through roof plumbing penetration applications is the only lead on the Project.

D. The Selected Offeror (Contractor) **must** execute Affidavit of Non-Asbestos, Lead, and PCB Use (attached to Section 00 40 14) and submit at Project Closeout. The Subcontractors to the Contractor **must** execute Close-out Form “D”, Subcontractors Hazardous Material Certificate (attached to section 01 77 01), and submit at Project Closeout.

1.19 PROPOSAL EVALUATION WAIVER

A. By submitting a proposal, each offeror agrees to waive any claim it has or may have against the District and its respective employees, the Program Manager and their respective employees, the Architect/Engineer and consultants, and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal; waiver of any requirements under the Proposal Documents, acceptance or rejection of any proposals; and award of the contract.

B. All Offeror’s **must** execute Proposal Evaluation Waiver (attached to 00 65 01) and submit with their Proposal.

1.20 CONFLICT OF INTEREST QUESTIONNAIRE

A. According to Local Government Code, Chapter 176, a person or an agent of a person who contracts or seeks to contract for the sale or purchase of property, goods, or services with any government agency must file a completed Conflict of Interest Questionnaire with the records administrator of the local government not later than the seventh business day after the date that the person begins

contract discussions or negotiations with the District or submits to the District an application, response to a request for proposals or bids, correspondence, or another writing related to a potential agreement with the District.

B. All Offeror's and sub-offeror's proposing to do work with the District **must** execute the Conflict of Interest Questionnaire (attached to Section 00 11 00) and submit with their Competitive Sealed Proposal Notice package.

1.21 CRIMINAL HISTORY RECORDS

A. Prior to commencing any work on this Project, the Selected Contractor shall certify, on the form provided Criminal History Record Information (attached to Section 00 40 17), for each of its employee who will have direct contact with students, the Selected Contractor has obtained, as required by Texas Education Code Section 22.0834:
   1. National criminal history record information from a law enforcement or criminal justice agency for each employee of the Selected Contractor hired before January 1, 2008 who will have direct contact with students; and
   2. National criminal history record information from the Texas Department of Safety for each employee of the Selected Contractor hired on or after January 1, 2008 who will have direct contact with students; Fingerprinting is required and shall be provided by the contractor (applicant) and administered through FAST (Fingerprint Applicant Services of Texas) which will be recorded by the District in the FACT (Fingerprint-based Applicant Clearinghouse of Texas). Currently applicant must obtain fingerprinting from L-1 Identity Solutions Company, (888) 467-2080, or schedule an appointment online at: https://tx.ibtfingerprint.com/.

B. Any personnel who will have direct contact with students must not have been convicted of an offense identified in Texas Education Code Section 22.085.

C. At this time, Senate Bill 9 applies only to contractors with direct contracts with the District. This requirement does not apply to sub-contractors of the Contractor, material suppliers, or a one-time service provider such as a service technician, delivery person, testing agent, code official, or similar personnel. However, changes to these requirements are anticipated and may require the acquisition and submittal of additional background checks to the District during the course of the Work.

D. The Selected Contractor shall execute and submit, Certification of Criminal History Record Information (attached to Section 00 40 17), Review by Contractor-Employer along with required list documenting proposed employees/ contractor personnel to be working on site, within 10 days after receipt of Notice To Proceed and prior to commencement ofWork.

E. Furthermore, an updated list employees/ contractor personnel shall be submitted weekly to the District indicating changes to contractor personnel with accompanying certifications and criminal history records. Any fingerprinting and photographing required by the aforementioned code will be the responsibility of the Contractor-Employer.

1.22 AVAILABILITY OF MATERIALS AND SYSTEMS

A. A serious effort has been made to select only materials that are systems that are readily available. As far as is known at proposal time all items are either available "off the shelf" or within a relatively short period of time. If during the proposal period, an Offeror becomes aware of an availability or delivery problem with any of the specified systems or materials, he should notify the Architect immediately. The Architect will promptly explore possibilities for selecting other systems or materials which would circumvent the problem and notify Offerors of any changes in an addendum, otherwise it will be understood that only specified systems and materials that are readily available are included in the proposals.

1.23 DETERMINATION OF SUCCESSFUL RESPONDENT AND AWARD OF CONTRACT

A. In determining the Selected Offeror, the Owner will evaluate the information submitted on the Proposal Form (attached to Section 00 11 00).

B. The Selection Committee consisting of LCISD administrators, architects, and other staff will make an initial evaluation of the proposals. The committee's recommendation will be considered by the LCISD Board of Trustees ("Board"). The final decision-making authority on the proposals rests with the full Board. Decision-making authority has not been delegated to any person or entity other than the Board.

C. The District will make such investigations as it deems necessary to determine the ability of the offeror to perform the Work, and the offeror shall furnish all such information and data for this purpose as may be requested. The District reserves the right to reject any proposal if the evidence submitted by, or investigation of, such offeror fails to satisfy the District that such offeror is properly qualified to carry out the obligations of the Contract and to complete the Work contemplatedtherein.

D. The District reserves the right to reject any or all proposals and to waive any formalities or irregularities and to make the award of the contract in the best interest of the District.

E. A decision regarding determination of the successful Offeror will be made by the District as soon as practical.

1.24 USE OF ASBESTOS FREE MATERIALS, PRODUCTS AND SYSTEMS

A. The Offeror is reminded to refer to the Paragraph below for requirements during the Proposal period and the following requirements during performance of the Work regarding the use of asbestos free materials, products and systems in the Project.

1. Since many materials, products and systems are proprietary, it is not possible to know all of the materials or components which go into producing such material, product or system without the manufacturer divulging trade secrets or patent information. Every effort has been made to specify materials, products or systems, which either as an "off the shelf" material, product or system or as a custom material, product or system do not containasbestos.
2. It is the Contractor's responsibility to submit an affidavit from the manufacturer to ascertain that every material, product or system used in the Project does not contain asbestos. In the event the material, product or system is found to contain asbestos, the Contractor shall offer for the Architect's consideration a substitution which he knows does not contain asbestos.
3. Even though a material, product or system is specified or a specification is based on a particular material, product or system, the Contractor will not be relieved from the responsibility to ascertain that materials, products and systems used in the Project do not contain asbestos. Under no circumstances shall a material, product or system which is known, suspected or found to contain asbestos be used on the Project.
4. If a material, product or system containing asbestos is used, the Contractor shall remove and replace the material, product or system with one which is asbestos free at no additional expense to the Owner, including removal and replacement of other materials affected by the removal of the asbestos bearing material, product or system, i.e. gypsum wallboard removed, replaced, and repainted on account of insulation being removed,etc.

END OF SECTION 00 20 00

SECTION 00 40 01
PROPOSAL BOND

KNOW ALL MEN BY THESE PRESENTS, that we_____, as Principal, and_____, as Surety, are held and firmly bound unto the **Lamar Consolidated Independent School District**, Rosenberg, Texas, hereinafter called the Owner, in the penal sum of _____ Dollars ($_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has submitted the accompanying Proposal, dated_____, 20_, being for **Prototype #2 – Elementary School #38**, the kind and extent of work involved being set forth in detail in the proposed Contract Documents cited herein.

NOW, THEREFORE, if the Principal shall not withdraw the accompanying proposal within 30 days after the date set for opening thereof, and shall within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the Owner in accordance with the Proposal as accepted; and give Bond and good and sufficient surety for the faithful performance and proper fulfillment of such contract including payment of all persons supplying labor or materials therefor, or in the event of the withdrawal of said proposal within the period specified, or the failure to enter into such contract and give such bond within the time specified, if the Principal shall pay to the Owner the difference between the aggregate amount for which the Owner may enter into a contract for the same work with another Respondent; if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

IN WITNESS WHEREOF, the above bonded parties have executed this instrument under their several seals this_____day of_____, 20_, the name and Corporate Seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representatives, pursuant to authority of its governing body.

_____ _____
Business Address Individual Principal

_____ _____
Business Address Individual Principal

ATTEST:

_____ BY:_____
Secretary President

_____ _____
Business Address Corporate Surety

ATTEST:_____ BY:_____

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

END OF SECTION 00 40 01

SECTION 00 40 12
LIST OF SUBCONTRACTORS

PROJECT:
Prototype #2 – Elementary School #38
Lamar Consolidated Independent School District

ARCHITECT:
Pfluger Architects
2 Greenway Plaza, Ste 460
Houston, Texas 77046

ARCHITECT'S PROJECT NO. 24-028

CONTRACTOR:

DATE: _____

List Subcontractors and others proposed to be employed on the above Project as required by the proposal documents.

(To be filled out by the Contractor and submitted with Proposal.)

LIST ONLY ONE SUBCONTRACTOR PER CATEGORY. IF MORE THAN ONE PER CATEGORY IS LISTED, THE OWNER WILL HAVE THE RIGHT TO SELECT SUBCONTRACTOR.

Work/ Division	Firm	Address	Phone	Fax	E-mail	Representative

(Provide additional sheets as required.)

RETURN THIS DOCUMENT 24 HOURS AFTER SUBMISSION OF PROPOSAL TO ARCHITECT VIA EMAIL.

END OF DOCUMENT 00 40 12

SECTION 00 40 13
AFFIDAVIT OF NON-DISCRIMINATORY EMPLOYMENT

STATE OF TEXAS)
)
COUNTY OF HARRIS)

AFFIDAVIT

This Company, Contractor, or Subcontractor agrees to refrain from discrimination in terms and conditions of employment to the basis of race, color, religion, sex, or national origin, and agrees to take affirmative action as required by Federal Statutes and rules and Regulations issued pursuant thereto in order to maintain and ensure non-discriminatory employment practices.

_____
Company

_____
Printed Name

_____
Signature

STATE OF TEXAS)
)
COUNTY OF HARRIS)

Sworn to and subscribed before me at_____, Texas, this the _____ day of _____, 20_____.

_____
Notary Public in and for Harris County, Texas

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

END OF DOCUMENT 00 40 13

SECTION 00 40 14
AFFIDAVIT OF NON-ASBESTOS, LEAD, AND PCB USE IN PROJECT

Upon completion of this form, return to the Architect upon close-out of the project.

PROJECT:
Prototype #2 – Elementary School #38
Lamar Consolidated Independent School District

ARCHITECT:
Pfluger Architects
2 Greenway Plaza, Suite 460
Houston, Texas 77046
Phone: 713.222.1141
Attention:
Raleigh Sullivan
raleigh.sullivan@pflugerarchitects.com

ARCHITECT'S PROJECT NO. 24-028

CONTRACTOR:

DATE: _____

AFFIDAVIT

The undersigned affirms and certifies that "to the best of their knowledge and belief asbestos, lead, and PCB containing materials have not been used or incorporated into the Work and lead or lead bearing materials have not been incorporated into potable water systems", including, but not limited to those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibbs, as applicable to the project, and that lead sheet flashing used in through roof plumbing penetration applications is the only lead on the Project.

_____
Company

_____
Printed Name

_____
Signature

STATE OF TEXAS)
)
COUNTY OF_____)

Sworn to and subscribed before me at_____, Texas, this the _____ day of _____, 20_____.

_____
Notary Public in and for_____County, Texas

RETURN THIS DOCUMENT IN CLOSEOUT PACKAGE

END OF SECTION 00 40 14

SECTION 00 40 17 CRIMINAL HISTORY RECORD INFORMATION

CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION REVIEW BY PUBLIC CONTRACTOR

Certifying Affidavit submitted to:

Name of School District: _____

Mailing Address: _____

_____

Project/Agreement: _____

_____

STATE OF TEXAS §

COUNTY OF_____ §

(1) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to Lamar Consolidated Independent School District (the "District") the following (please check the option that applies):

☐ Such firm has obtained, reviewed and verified, from a law enforcement or criminal justice agency, the criminal history record information of all employees of the contracting firm who (i) have or will have continuing duties related to the contracted services, and (ii) have or will have direct contact with students (substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional District employee). The undersigned further certifies that no employees of the contracting firm who meet the requirements of (i) and (ii) herein have been convicted of any offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy.

☐ Such firm has ensured that all employees of the contracting firm who (i) have or will have continuing duties related to the contracted services, and (ii) have or will have direct contact with students (substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional District employee) have submitted all information necessary for the LEE Fast Pass process, but such firm does not have access to the results of the criminal history search.

☐ No employees, including the undersigned, have or will have direct contact with students, as defined by Tex. Admin Code §153.1101(7).

☐ If the public work involves an existing "instructional facility," as defined by Tex. Ed. Code §46.001, such firm certifies that (1) the public work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence that is not less than six feet in height; and (2) that the contractor has adopted a policy prohibiting employees, including subcontractor employees, from interacting with students or entering areas used by students, informs employees of the policy, and enforces the policy at the public work area. Such firm further certifies that it has an ongoing responsibility to make a reasonable effort to ensure that the aforementioned conditions/precautions continue to exist throughout the time that the contracted services are provided.

(3) The undersigned firm swears and covenants that no present or future employee of the contracting firm, no present or future independent contractor, and no present or future employee or independent contractor of any subcontractor of the contracting firm, will provide services to the Project on a continuing basis that involve direct contact with students unless and until undersigned firm has submitted all information necessary for such employee's or independent contractor's national criminal history record information to be reviewed and cleared by the District. In the event of an emergency, an employee or independent contractor who has not been previously certified may only provide services that involve direct contact with students if such employee is escorted by a District employee.

(4) The undersigned firm swears and covenants that, upon receipt of information, directly or indirectly, that any employee or independent contractor of the contracting firm has been convicted of an offense identified in Section 22.085 of the Texas Education Code or prohibited by District policy, the contracting firm will immediately remove or cause the removal of such employee from the Project or scope of the Agreement and notify the District.

(5) If applicable, the undersigned agrees that its use of the District's DPS LEE Pass account/number to obtain criminal history information in no way creates any agency relationship between the District and the undersigned or its employees.

_____, being duly sworn, affirms and certifies that he/she is the _____ (position) of_____(contracting firm), and that all statements and acknowledgements contained herein are true and correct, and that he/she has the authority to bind such firm to the covenants set out above.

_____

SUBSCRIBED AND SWORN TO BEFORE ME this_____day of_____, 20_____.

Notary Public _____State of _____

My Commission expires _____

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

END OF SECTION 00 40 17

EVALUATION CRITERIA FOR PROPOSAL

This proposal shall be evaluated using the evaluation criteria listed below.

	Evaluation Criteria	Point System
1	**Purchase price –** Proposal should offer a fair and reasonable price for services to be procured by Lamar CISD. Pricing will be calculated using the Price Delivery Sheet in this document.	40
2	**Reputation of the vendor and of the vendor's goods or services –** Proposer should have a solid reputation with other ISDs, government or collegiate entities that shows a high level of customer service and a high level of quality of goods or services. References will be contacted via e-mail.	10
3	**Quality of the vendor's goods or services –** Overall assessment of vendor's services. Vendor will be expected to meet schedules and operate with minimal disruption in accordance with the outlined specifications.	10
4	**Extent to which the goods or services meet the district's needs** Assessment of Submitted Project Plan and Schedules	10
5	**Vendor's past relationship with the district** 8-10: Good business with LCISD, staff recommends use again 5-7: Good business with no documented issues **OR** never performed business with LCISD but has experience with other school districts or government entities. 1-4: Past performance was documented as being poor**.**	10
6	**Proposed team offers experience and knowledge base required for the project** • Organizational chart of proposed project team • Resume of each proposed team member	10
7	**Ability to provide proper bonds and insurance requirements –** Provide proof of proper insurance and bonding capacity.	5
8	**Safety Record** Vendor must submit copy of Experience Modifier Rate (EMR) for the last three years. The totals for the three years are calculated and averaged to receive the points below. 5 - EMR of .50 or less 4 - EMR 0.51-0.85 3 - EMR 0.86-0.99 2 - EMR greater than 1.0 1 - EMR not included	5
9	**Total**	**100**

CRITERIA NOTES:

Careful consideration should be given to all items of the above Evaluation Criteria table. The points awarded to each item will be based on **how well each submission:**

1. Provides thoroughly developed, competitive pricing using the tables in Pricing Delivery Information of this CSP.

2. Provides evidence of experience in general and the ability to perform services to a district similar to Lamar CISD and names & contact information for references.

3. Provides evidence related to the quality of services, as well as the results of references provided by each respondent.

4. Provides an effective plan and schedule that addresses the scope presented in the request for proposals.

5. Provide list of history of projects with Lamar CISD.

6. Provides information describing experience and qualifications of onsite leadership and key staff to be assigned to the contracted work.

7. Provides an adequate and current certificate of insurance coverage.

8. Provides evidence of participation in an OSHA compliant safety program and any other safety policies in place.

PLEASE PROVIDE RESPONSE TO EACH OF THESE CRITERIA QUESTIONS IN YOUR SUBMISSION PACKAGE.

SECTION 00 65 01
PROPOSAL EVALUATION WAIVER

By submitting a Proposal, the proposer indicated below agrees to waive any claim it has or may have against the Owner, Architect, Engineers, Consultants and their respective employees, arising out of or in connection with the administration, evaluation, or recommendation of any proposal. The proposer further agrees the Owner reserves the right to waive any requirements under the proposal documents or the Contract Documents, with regards to acceptance or rejection of any proposals, and recommendation or award of the contract.

NOTE: The Statement of Affirmation Must Be Notarized.

STATEMENT OF AFFIRMATION

"The undersigned affirms that he/she is duly authorized to execute this waiver by the person(s) or business entity making the proposal.

Firm's Name_____

Address: _____

_____

Proposer's
Name_____Position/Title
_____

Proposer's
Signature_____Date
_____

Subscribed and sworn to me on this_____day of_____, 20_.

_____
Notary Public

My Commission expires _____

RETURN THIS DOCUMENT IN BID/PROPOSAL PACKAGE

END OF SECTION 00 65 01

SECTION 00 72 00 CONTRACT DOCUMENTS

I. CONSTRUCTION CONTRACT AGREEMENT

A. The contract for the construction of the project shall be executed by the successful Offeror on the 2017 Edition of AIA Document A101 "Standard Form of Agreement Between Owner and Contractor." Said contract, fully executed, shall be delivered to the Owner within ten (10) days of receipt of said contract.

II. CONDITIONS OF THE CONTRACT

A. The General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition, is hereby specifically made a part of the Contract Documents, whether attached hereto or not; and as supplemented and amended herein, constitutes the General Conditions.

B. Supplementary Conditions:

1. The Supplementary Conditions contain modifications to the General Conditions of the Contract for Construction, AIA Document A201. Where any part of that document is modified by Supplementary Conditions, the unaltered provisions of the General Conditions shall remain in effect. Refer to Section 00 73 00 for the Supplementary Conditions.

III. AVAILABILITY

A. Printed copies of these documents may be examined in the Architect's office. A.I.A. Documents may be obtained from the Houston Chapter of the American Institute of Architects, 315 Capitol, Suite 120 Houston, Texas 77002; (713) 520-0155. Copies may also be obtained from local architects' supplies stores.

B. Failure to obtain and examine these documents in no way relieves the Contractor, Subcontractors, Sub-subcontractors, and material suppliers of responsibilities incorporated in the Agreement.

END OF SECTION 00 72 00

S

SECTION 00 73 00 A201 LCISD SUPPLEMENTARY CONDITIONS

SUPPLEMENTARY CONDITIONS TO THE AIA DOCUMENT A201-2017
GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

The following supplements modify the "General Conditions of the Contract for Construction", AIA Document A201, Sixteenth Edition, 2017. Where a portion of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered portions of the General Conditions shall remain in effect. As appropriate, for purposes of this Request for Proposal, the term "Bid" shall mean "Proposal" and the term "Bidder" shall mean "Offeror", wherever they appear in the Construction Documents. The term "Contractor" shall include a Construction Manager-at-Risk.

ARTICLE 1 -- GENERAL PROVISIONS

1.1 BASIC DEFINITIONS

1.1.1 THE CONTRACT DOCUMENT

Delete Section **1.1.1** in its entirety and substitute the following:

1.1.1 The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Performance Bond, Labor and Material Payment Bond, Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to propose, instructions to Proposers, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's Proposal or portions of Addenda relating to proposal requirements).

To the extent any provision in the Supplementary Conditions to these AIA Document A201-2017 General Conditions, issued by Owner, conflicts with any provision in the Supplementary Conditions issued by the Architect; the Supplementary Conditions to these AIA Document A201-2017 General Conditions issued by Owner shall control.

1.1.3 THE WORK

Add the following sentence at the end of this section:
It also includes all supplies, skill, supervision, transportation services and other facilities and things necessary, proper or incidental to the carrying out and completion of the terms of the contract and all other items of cost or value needed to produce, construct and fully complete the public work identified by the Contract Documents.

Add the following Subparagraphs:

1.1.9 DESCRIPTION OF PARTIES

The following definitions apply to parties named in the Contract Documents.

1. Owner: Lamar Consolidated Independent School District
   3911 Avenue I
   Rosenberg, Texas 77471
   Phone: (832) 223-000

2. Architect: Pfluger Architects
2 Greenway Plazas, Suite 460
Houston, Texas 77046
Phone: (713) 222-1141

3. MEP/T Engineer:

4. Roofing/ Building Envelope:

a. CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following Sections:

1.2.1.2 Precedence of the Contract Documents: The most recently issued Document takes precedence over previous issues of the same Document. The order of precedence is as follows with the highest authority listed as "1".

.1 Contract Modifications (such as Change Orders) signed by the Contractor and Owner.
.2 The Agreement. (AIA Document A133-2019)
.3 The Supplementary Conditions
.4 The General Conditions of the Contract for Construction
.5 Addenda, with those of later date having precedence over those of earlier date
.6 Drawings and Specifications

Should these Documents disagree in themselves, the Architect and Owner will select the appropriate method for performing the Work, to facilitate avoiding increase in the Contract cost.

1.2.1.3 Relation of Specifications and Drawings: To be equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of Work indicated. In the event of the above mentioned disagreements, the resolution shall be determined by the Architect and Owner.

1.6 NOTICE

Delete the text of Section **1.6.1** in its entirety and substitute the following:

1.6.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer at the corporation for which is was intended, or if delivered at or sent by certified mail, or by registered or certified mail, or by courier service providing proof of delivery, to the last business address known to the party giving notice, or if delivered by facsimile or other electronic communications to the offices of the person or corporation for which it was intended. For facsimiles or other electronic communications received after 5:00 p.m. on a business day, or on a weekend or legal holiday on which the recipient's offices are closed, notice shall be deemed to have been duly served on the next business day.

Delete the text of Section **1.6.2** in its entirety.

Add Section **1.9** as follows:

1.9 MISCELLANEOUS OTHER DEFINITIONS

1.9.1 ADDENDA, ADDENDUM

Documents issued by the Architect prior to execution of the Owner Contractor Agreement for this Project that modify or clarify the Proposal Documents. All addenda become a part of the Contract Documents.

1.9.2 ALTERNATE PROPOSAL(S)

A separate amount stated on a separate Proposal Form which, if accepted by the Owner, will be added to or deducted from the Base Proposal. If accepted, the work that corresponds to the alternate proposal will become part of the agreement between Owner and Contractor. Alternate proposals shall remain valid for the same period of time as the Base Proposal after receipt of proposals, regardless if an Owner Contractor Agreement has been executed, unless indicated otherwise herein.

1.9.3 APPROVED, APPROVED EQUIVALENT, APPROVED EQUAL, OR EQUAL

The terms Approved, Approved Equivalent, Approved Equal, and Or Equal, relate to the substitution of products or systems approved in writing by the Architect. Refer to Paragraph 3.4.2, Substitution of Products and Systems, for procedures which must be followed after award of contract. The substitution procedure process to be followed prior to receipt of proposals is described in the Instructions to Offerors.

1.9.4 BASE PROPOSAL

The Contractor's proposal for the Work, not including any Alternates.

1.9.5 CONTRACT TIME

The period of time which is established in the Contract Documents for Substantial Completion of the Work. This period of time is subject to authorized adjustments as enumerated in the Contract Documents.

1.9.6 DATE OF AGREEMENT

The date the Owner formally awards a Contract for Construction of the Work. This date will be inserted in the first page of the Agreement between Owner and Contractor and shall be referenced in Performance Bond and Payment Bond forms. See also Date of Commencement of Work.

1.9.7 DATE OF COMMENCEMENT OF THE WORK

The date of a written Notice to Proceed to the Contractor for a given portion of the Work. This date constitutes day zero (0) of the stated Contract Time. The Notice to Proceed will be issued after the District has received and validated the Contractor's Payment Bond, Performance Bond and Insurance.

1.9.8 DATE OF FINAL COMPLETION

The end of construction. See AIA Document A201-2017, Section 9.10.

1.9.9 DAY

The following days are referenced in the documents:

.1 Calendar Days. Extensions of time granted for Regular Work Days lost, if any, will be converted to Calendar Days.

.2 Holidays: The days officially recognized by the construction industry in this area as a holiday; normally limited to the observance days of New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and the day after and Christmas Day.

.3 Regular Work Days: All calendar days except holidays, Saturdays, and Sundays. Requests for extensions of time shall be requested on the basis of Regular Work Days, and those days, if approved, will be converted to calendar days by multiplying by a factor of one and four-tenths (1.4).

.4 No extensions of the Contract Time will be granted due to inclement weather, except as provided in Section 8.3.1.

1.9.10 NOTICE TO PROCEED
A notice that may be given by the Owner to the Contractor that directs the Contractor to start the Work. It may also establish the Date of Commencement of the Work.

1.9.11 PROVIDE
Whenever the word "provide" is used in these documents, it shall mean the same as "furnish and install".

1.9.12 PUNCH LIST
A comprehensive list prepared by the Contractor prior to Substantial Completion to establish all items to be completed or corrected; this list may be supplemented by the Architect or Owner. See AIA Document A201, Section 9.8.

1.9.13 UNIT PRICES
A cost for a unit of work as described in the Contract Documents. The Owner may add or deduct Unit Price work at the amounts stated on the Proposal Form and such amounts shall not be subject to additional mark up by the Contractor or his subcontractors."

ARTICLE 2 – OWNER

2.1 GENERAL
Delete the text of Section **2.1.1** in its entirety and substitute the following:
2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. All parties understand that only the Board of Trustees for the Owner acting as a body corporate has the authority to bind the Owner with respect to all matters requiring the Board's approval under current policy of the Board of Trustees for the Owner, including, but not limited to, Change Orders. Except as otherwise provided in Section 4.2.1, the Architect does not have authority to bind the Owner with respect to matters requiring the Owner's approval or authorization. The term "Owner" means the Owner or the Owner's authorized representative.
Delete the text of Section **2.1.2** in its entirely.

2.2 EVIDENCE OF THE OWNER'S FINANCIAL ARRANGEMENTS
After the first sentence of Section **2.2.1,** delete the remainder of Section **2.2.1** in its entirety.
Delete Sections **2.2.2** and **2.2.3** in their entirety.

Add Section **3.1.4** as follows:

2.2.5 The Contractor will be furnished free of charge a total of 10 copies of the Drawings and a total of 25 copies of the Project Manual during the duration of the project. These copies may have been used during the Bid/Proposal process and it is the Contractor's responsibility to determine their completeness and to request replacement of any missing portions. Additional new copies will be furnished at the cost of reproduction, postage, and handling.

2.5 OWNER'S RIGHT TO CARRY OUT THE WORK
Delete the text of Section **2.5.** in its entirety and substitute the following:
If the Contractor defaults or neglects to carry out the work in accordance with the Contract Documents and fails, after receipt of written notice from the Owner, to commence and continue correction of suchdefault or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the actual cost of correcting such deficiencies, including the Owner's expenses and compensation for the Architect's additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to the prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner within thirty (30) days of receipt of written notice from the Owner therefor.

Add Section **2.6** as follows:
2.6 OWNER'S LACK OF LIABILITY TO THIRD PARTY

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he Owner is not responsible for the acts and/or omissions of, or contractually involved with, any subcontractors, suppliers of labor or materials, and/or their respective employees or agents or any other third-party claimants. Such claimants shall not constitute third party beneficiaries under this contract. The Contractor and/or his Surety solely shall deal with, take responsibility for, and be liable to such parties under this Contract. Contractor will indemnify and defend the Owner from any legal actions against Owner for unpaid bills of subcontractors.

Add Section **2.7** as follows:

2.7 OWNER'S RIGHT TO OCCUPY THE PROJECT

2.7.1 The Owner shall have the right to occupy or use without prejudice to the right of either party, any completed or largely completed portions of the project, notwithstanding the time for completing the entire work or such portions may not yet have expired. Such occupancy and use shall not constitute acceptance of any work not in accordance with the Contract Documents. If the Contractor determines that said occupancy may cause a delay to the completion of the project, he shall notify the Owner in writing immediately.

2.7.2 Refer to Article 11 Insurance and Bonds regarding property insurance requirements in the event of such occupancy.

2.7.3 If Contractor has not completed the obligations of the Contract Documents by the dates established by subsequent Amendments to the Agreement Between Owner and Construction Manager, the Owner shall have the right to occupy or use the entire project.

ARTICLE 3 -- CONTRACTOR

3.1 GENERAL

Add Section **3.1.4** as follows:

3.1.4 The Contractor must be fully qualified under any state or local licensing laws for Contractors in effect at the time and at the location of the work. The Contractor is responsible for determining that all of his subcontractors and prospective subcontractors are duly licensed in accordance with the law.

3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

Delete the last sentence of Section **3.2.4** in its entirety and substitute the following:
If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or architect for damages resulting from errors, inconsistencies, or omissions in the Contract

Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities provided such errors, inconsistencies, omissions, differences, or nonconformities could not have been ascertained from a careful study of the Contract Documents.

Add Sections **3.2.5, 3.2.6** and **3.2.7** as follows:

3.2.5 The Contractor shall make a reasonable attempt to interpret the Contract Documents before asking the Architect for assistance in interpretation. The Contractor shall not ask the Architect for observation of work prior to the Contractor's field superintendent's personal inspection of the work and his determination that the work of all major subcontractors is complete.

3.2.6 If, in the opinion of the Architect, the Contractor does not make a reasonable effort to comply with the above requirements of the Contract Documents and this causes the Architect or his Consultants to expend an unreasonable amount of time in the discharge of the duties imposed on him by the Contract Documents, then the Contractor shall bear the cost of compensation for the Architect's additional services made necessary by such failure. The Architect will give the Contractor prior notice of intent to bill for additional services related to Sections 3.2.5, 3.2.6 and 3.7 before additional services are performed.

3.2.7 If the Contractor has knowledge that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor his Warranty, he shall promptly notify the Architect in writing, providing substantiation for his position. Any necessary

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hanges, including substitutions of materials, shall be accomplished by appropriate Modification.

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

Delete the last sentence of Section **3.3.1** in its entirety and substitute the following:

If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any resulting loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures, but only to the extent the Owner would be responsible for any such losses or damages under state and/or federal law.

Add Sections **3.3.4** and **3.3.5** as follows:

3.3.4 The Contractor is especially cautioned to coordinate the routing of mechanical and electrical items prior to commencing these operations.

3.3.5 Contractor shall bear sole responsibilities for design and execution of acceptable trenching and shoring procedures, in accordance with Texas Government Code, Section 2166.303 and Texas Health and Safety Code, Subchapter C, Sections 756.021, et seq. On trench excavations in excess of 5 feet in depth, Contractor shall pay a qualified engineer, experienced in the engineering design and preparation of drawings and specifications for compliance with state requirements for trenching and shoring, to prepare and professionally seal detailed drawings and specifications directing Contractor in the safe execution of trenching and shoring.

3.3.6 Any time that the Contractors' employees, subcontractors and their agents and employees, and other persons or entities performing portions of the work for or on behalf of the Contractor or any of its subcontractors are on site, the work shall be supervised by a qualified employee of the Contractor.

3.4 LABOR AND MATERIALS

Delete Section **3.4.2** in its entirety and replace it with the following:

3.4.2 The materials, products, and the systems covered by these specifications have been selected as a standard because of quality, particular suitability, or record of satisfactory performance. It is not intended to preclude the use of equivalent or better materials, products, or systems provided that same meets the requirements of the particular project and have

been approved in an addendum as a substitution prior to the submission of bids. If prior written approval in an addendum has not been obtained, it will be assumed that the Bid is based upon the materials, products, and systems described in the Bidding Documents and no substitutions will be permitted, except as provided hereinafter.

.1 If, after award of contract, the Contractor of one of his Subcontractors, or Suppliers determines that any of the products or systems specified will perform in a manner that will limit the Contractor's ability to satisfactorily perform the work or to honor the Warranty, the Contractor shall promptly notify the Architect, in writing, providing detailed substantiation for his position. Any changes deemed necessary by the Owner and Architect, including substitution of materials and change in Contract Sum, either upward or downward, if any, shall be accompanied by appropriate Modification.

.2 After the Contract has been executed, the Owner and Architect will consider a formal request for the substitution of products on the Work in place of those specified only under the conditions set forth in specification referring to Product Options and Substitutions.

.3 Requests for substitution, received by the Architect later than forty five (45) days after "Notice to Proceed" or "Date of Commencement of the Work" (whichever occurs first), may result in additional costs to the Owner. Contractor agrees to reimburse the Owner through deductive Change Order to the Contract, for all costs associated with such requests.

.4 By making request for substitutions based on Subparagraph 3.4.2 above, the Contractor

.1 represents that the Contractor has personally investigated the proposed substitute product and determined that it is equivalent or superior in all respects to that specified, and is suitable for the intended purpose;

.2 represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;

.3 certifies that the cost data presented is complete and includes all related costs

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nder this Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects.

.5 Substitution requests shall be submitted on the forms included herein and in accordance with the process established in specification referring to Product Options and Substitutions.

Add the following Sections after Section **3.4.3**

3.4.3 **.1** State law prohibits possession and/or use of alcohol and tobacco products on school property at all times.

.2 State law prohibits weapons or firearms on school property.

.3 There shall be zero tolerance for fraternization with students, teachers and any other school district personnel, Contractor will immediately remove any employee that violates this provision from the project.

.4 No glass bottles shall be brought on the construction site or Owner's property by any construction personnel.

3.5 WARRANTY

Delete the text of Section 3.5.1 in its entirety and substitute the following:

3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment

furnished under the Contract will be of good quality and new, unless the Contract Documents require or permit otherwise. The contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect cause by abuse, material alteration to the Work not executed by the Contractor, insufficient maintenance or maintenance not in compliance with written instructions therefor, operation not in compliance with written instructions therefor, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

Add Sections **3.5.3, 3.5.4** and **3.5.5** as follows:

3.5.3 In the event of failure in the Work, including a specified product, whether during construction, or the correction period (which shall be one (1) year from the Date of Substantial Completion, except where a longer period as specified), the Contractor shall take prompt and appropriate measures to assure correction or replacement of the defective Work or any portion thereof, including manufactured products, whether notified by the Owner or the Architect. Upon correction of warranty items, the Contractor shall provide the Owner and Architect with written notification of said correction. This obligation shall survive acceptance of the Work under the Construction Contract.

3.5.4 The Contractual Correction Period for this Project is one (1) year from the date of Substantial Completion, except for any extended warranties as specified within the Contract Documents. Items of Work not completed until after the deadline for Substantial Completions shall have their warranties (general and any extended warranty periods) extended by the period of time between the deadline for Substantial Completion and the actual completion of the Work. Such warranties shall be submitted to the Owner in writing, documenting such time extensions. This correction period shall not restrict or modify extended warranties called for or provided on systems, equipment or other specific portions of the Work.

3.5.5 The Contractor shall accompany the Owner and Architect for a complete reinspection of the Project approximately eleven (11) months after the Date of Substantial Completion and shall promptly complete any observed or reported deficiencies in the Work, including any uncompleted Punch List items or outstanding and incomplete warranty items. The contractor shall provide written notification to the Owner and Architect when said Punch List items and/or additional deficiencies observed have been corrected. This obligation shall survive acceptance of the Work under the Construction Contract.

3.6 T
AXES

Delete Section **3.6** in its entirety and substitute the following:

The Owner qualifies for exemption from State and Local Sales and Use Taxes pursuant to the provision of Article 20.04(f) of the Texas Limited Sales, Excise and Use Tax Act. Taxes normally levied on the purchase, rental and lease of materials, supplies and equipment used or consumed in performance of the Contract may be exempted by issuing to suppliers an exemption certificate in lieu of tax. Exemption certificates comply with State Comptroller of Public Accounts Ruling No. 95-0.07. Any such exemption certificate issued in lieu of tax shall be subject to State Comptroller of Public Accounts Ruling No. 95-0.09, as amended. Failure by the Contractor or Subcontractors to take advantage of the Owner's exemption and to obtain such exemption certificate shall make him responsible for paying taxes incurred on materials furnished on the Project without additional cost to or reimbursement by the Owner.

3.7 PERMITS, FEES, NOTICES AND COMPLIANCES WITH LAWS

After Section **3.7.1**, add the following Sections:

3.7.1 **.1** The Owner shall pay directly to the governing authority the cost of all permanent property utility assessments and similar utility connection charges.

.2 The Contractor shall pay directly all temporary utility charges (excluding permanent power), utility district/company inspection fees, temporary tap charges, and temporary water meter charges and any other similar fees assessed by jurisdictional authority having control over this Project. The Contractor shall secure and pay for all governing authorities' permit fees.

.3 Fees payable to the Texas Department of Licensing and Regulation (TDLR) for document review relative to the Elimination of Architectural Barriers Act shall be paid by the Owner and the Architect will submit the documents to the TDLR for review and approval.

.4 The Contractor shall pay for all measures required for the SWPPP.

3.8 ALLOWANCES

Delete Section **3.8** in its entirety and substitute the following:

3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct and approve in writing. All unused allowance amounts shall be credited back to Owner, along with any markups included in the Contract Sum on such unused amounts.

3.9 SUPERINTENDENT

Delete Section 3.9.1 in its entirety and substitute the following:

3.9.1 The Contractor shall employ competent superintendents, project manager(s) and necessary assistants who shall be in attendance at the Project site during performance of the Work, including Punch List work. The superintendents and project manager(s) shall represent the Contractor, and unless provided otherwise in Section 3.1.1, communications given to the superintendents or project manager(s) shall be binding as if given to the Contractor.

Modify sections 3.9.2 & 3.9.3 to also include Project Manager as follows:

3.9.2 The Contractor shall identify the names and qualifications of proposed superintendents and project manager(s) within the Contractor's submitted Proposal. Within 30 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendents and project manager(s) or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

3.9.3 The Contractor shall not employ a proposed superintendent and project manager to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendents or project manager(s) without the Owner's consent, which shall not unreasonably be withheld or delayed.

3.10 C

ONTRACTOR'S CONSTRUCTION AND SUBMITTAL SCHEDULES

Delete Section **3.10.1** and substitute the following:

3.10.1 Within 30 days of being awarded an Amendment, the Contractor shall prepare and submit for the Owner and Architect's review, a construction schedule for the Work, with critical path, schedule milestone dates, and Owner activities clearly defined. The schedule shall not exceed time limits current under the Contract Documents. For further schedule requirements refer to specification section regarding project schedules in the Project Manual.

Add Section **3.10.4** as follows:

3.10.4 The Contractor shall submit to the Architect, with each monthly Application for Payment; a copy of the progress schedule updated to reflect the current status of the project.

The Contractor shall take whatever action necessary to assure that the project completion schedule is met.

3.11 DOCUMENTS AND SAMPLES AT THE SITE

Add Section **3.11.1** as follows:

3.11.1 The Contractor shall post all Addenda on Construction Documents prior to commencing work in the site.

Add Section **3.11.2** as follows:

3.11.2 The Contractor shall utilize PlanGrid Construction productivity software to provide current and up to date contract documents storage.

Add Section **3.11.3** as follows:

3.11.3 The Contractor shall hold at least (2) two E-Builder licenses. The annual user license for Lamar CISD is $1,941.00 per year. Contractor shall maintain the licenses throughout the project duration. Contractor will be responsible for keeping all project documents up-to-date.

3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

At Section **3.12.5**, add the following Sections:

3.12.5 .1 If, in the opinion of the Architect, the Shop Drawings, Product Data, Samples and similar submittals are incomplete, indicate an inadequate understanding of the work covered by the submittals, or indicate a lack of study and review by the Contractor prior to submittal to the Architect, the submittals will be returned, unchecked, to the Contractor for correction of these three deficiencies and subsequent resubmittal. Additional service charges as outlined in 3.2.6 may be charged by the Architect in this event.

.2 The Architect will take no action on Shop Drawings, Product Data, and Samples that have not first been certified, by stamped, signed notation, as having been checked and approved by the Contractor for use in the Work, or that are not specifically required by the Contract Documents.

At Section **3.12.7**, correct the word "approved" in the last line to read "accepted".

At Section **3.12.8**, correct "Architect's approval" in the last line to read "Architect's acceptance".

At Section **3.12.9**, correct "Architect's approval" in the last line to read "Architect's acceptance" and add the following Section:

3.12.9.1 Deviation from the requirements of the Contract Documents indicated on shop Drawings, Product Data, and Samples, does not constitute the required notification "in writing".

Add Sections **3.12.11** and **3.12.12** as follows:

3.12.11 The Contractor shall submit complete Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents to the Architect at least thirty (30) days prior to the date the Contractor needs the reviewed submittals returned. Where colors are to be selected by the Architect, submit all Samples in adequate time to allow the Architect to prepare a complete selection schedule. In general, all submittals requiring color selection shall be submitted to the Architect within four weeks of the date of the contact for construction.

3.12.12 The Contractor shall submit digital PDF's of Shop Drawings, Product Data, and similar submittals in the proper format according to the procedures stipulated within the Contract Documents. Digitally

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submitted Shop Drawings will be reviewed and marked by the Architect and/or his consultants and returned to the Contractor for his use, distribution, correction or resubmittal as required. Contractor corrections or revisions shall be resubmitted to the Architect in accordance with same procedures. The digitally marked up prints will be retained by the Architect and his consultants. Samples shall be submitted directly to the Architect for review.

Add Section 3.**12.13** as follows:

3.12.13 The Contractor shall provide MEP coordination drawings and MEP coordination models (BIM Services) within a schedule mutually agreed upon by the Team and prior to installing the Work, showing how all piping, ductwork, lights, conduit, equipment, etc. will fit into the ceiling space allotted, including clearances required by the manufacturer, by code, or in keeping with good construction practice. Space for all trade elements must be considered on the same drawing. Drawings shall be at ¼ inch per foot minimum scale and shall include invert elevations and sections required to meeting intended purpose. The Contractor may propose an alternate method of accomplishing MEP coordination. If the alternate method is approved by the Team, it may be utilized.

3.14 CUTTING AND PATCHING

Add Section **3.14.3** as follows:

3.14.3 Leave all chases, holes and openings, straight and true, of proper size, and cut them into existing work as may be necessary for the proper installation of the work. Consult with all Subcontractors concerned, regarding proper locations and size. In case of conflict between requirement for cutting and patching and any other requirement of the Work, submit request for direction before proceeding with the Work. In case of failure to leave or cut them in the proper place, openings shall be cut afterward at no expense to the Owner. No excessive cutting will be permitted, nor shall any piers or other structural members be cut without prior

approval. After such work has been installed, satisfactorily and carefully fit around, close up, repair, patch, and point up all cuts. Work shall be done with proper tools by workmen of the particular trade to which work belongs and shall be done without extra expense to the Owner. No description of specific cutting, patching, digging, etc., required for the work under a Specification Section that may be required for the proper accommodation of that work to the work of other trades shall relieve the Contractor from responsibility described above.

3.15 CLEANING UP

Add Section **3.15.3** as follows:

3.15.3 Prior to the Architect's inspection for Substantial Completion the Contractor shall clean exterior and interior surfaces exposed to view; remove temporary labels, stains, and foreign substances; polish transparent and glossy surfaces; clean equipment and fixtures to a sanitary condition; replace air filters in mechanical equipment; clean roof, gutters, and downspouts; remove obstructions and flush debris from drainage systems; clean site; sweep paved areas and rake clean other surfaces; remove trash and surplus materials from the site.

3.18 INDEMNIFICATION

Delete Sections **3.18.1** and **3.18.2** in their entirety and replace them with the following:

3.18.1 TO THE FULLEST EXTENT PERMITTED BY LAW, CONTRACTOR SHALL INDEMNIFY DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES (COLLECTIVELY, THE "INDEMNIFIED PARTIES") FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, ATTRIBUTABLE TO BODILY INJURY, SICKNESS, DISEASE OR DEATH OF ANY EMPLOYEE OF CONTRACTOR, ITS AGENTS, OR ITS SUBCONTRACTORS OF EVERY TIER, EVEN IF THE BODILY INJURY, SICKNESS, DISEASE OR DEATH IS CAUSED BY OR ALLEGED TO HAVE BEEN CAUSED BY THE NEGLIGENCE, FAULT OR STRICT LIABILITY OF ANY OF THE INDEMNIFIED PARTIES.

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OR ALL CLAIMS NOT ADDRESSED IN THE ABOVE PARAGRAPH, CONTRACTOR SHALL INDEMNIFY, DEFEND AND HOLD HARMLESS THE OWNER AND ITS TRUSTEES, OFFICERS, AGENTS, AND EMPLOYEES AND (COLLECTIVELY, THE "INDEMNIFIED PARTIES"), FROM AND AGAINST ALL CLAIMS, LOSSES, EXPENSES, COSTS, DEMANDS, SUITS, CAUSES OF ACTION, AND DAMAGES, INCLUDING WITHOUT LIMITATION, ATTORNEYS' FEES AND EXPENSES, OF ANY NATURE WHATSOEVER ARISING OUT OF OR RELATED TO THIS AGREEMENT OR THE WORK TO BE PERFORMED UNDER THIS AGREEMENT, BUT ONLY TO THE EXTENT OF THE NEGLIGENCE OR OTHER FAULT OF THE CONTRACTOR, ITS AGENTS, REPRESENTATIVES, EMPLOYEES OR SUBCONTRACTORS OF ANY TIER.

3.18.2 It is understood and agreed that Subparagraph 3.18 above is subject to, and expressly limited by, the terms and conditions of TEX. CIV. PRACT. & REM. CODE ANN. 130.001-130.005 (Vernon Supp. 1989), as amended or modified, or any successor statute. Contractor shall not be obligated under Subparagraph 3.18 to indemnify or hold harmless Architect or any agent, servant of employee of Architect from liability or damage that is caused by or results from:

.1 defects in plans, designs or specifications prepared, approved or used by the Architect; or

.2 negligence of the Architect in the rendition or conduct of professional duties called for or arising out of the Contract Documents and the plans, designs or specifications that are a part of the Contract Documents; and arises from:

- **.1** personal injury or death;
- **.2** property injury; or
- **.3** any other expense that arises from personal injury, death or property injury.

Add Section **3.18.3** as follows:

3.18.3 It is agreed with respect to any legal limitations, now or hereafter in effect and affecting the validity or enforceability of the indemnification obligation under Paragraph 3.18, such legal limitations are made a part of the indemnification obligation and shall operate to amend the indemnification obligation to the minimum extent necessary to bring the provision into conformity with the requirements of such limitations, and as so modified, the indemnification obligation shall continue in full force and effect.

Add Sections **3.19**, **3.20,** and **3.21** as follows:

3.19 RECORD DRAWINGS

3.19.1 Refer Owner's Closeout Procedures

3.20 PREVAILING WAGE RATES

3.20.1 As required by Chapter 2258 of the Texas Government Code Title 10 Prevailing Wage Rate, no employee used in this construction may be paid less than the minimum prevailing wage rate in effect for the Owner.

3.20.2 The Contractor and each Subcontractor and Sub-subcontractor shall pay to all laborers, workmen, and mechanics employed in execution of this Contract not less than rates set forth by law for each craft of type of workman or mechanic needed to execute this Contract.

3.20.3 Determination of prevailing wages shall not be construed to prohibit payment of more than the rates identified.

3.21 ANTITRUST VIOLATIONS

3.21.1 Contractor hereby assigns to Owner any and all claims for overcharges associated with this Contract which arise under the antitrust laws of the United States, 15 U.S.C.A. Section 1 et.seq. (1973). The Contractor shall include this provision in his contracts with each Subcontractor and Supplier. Each Subcontractor shall include such provision in contracts with Sub-subcontractors and suppliers.

3.22 THIRD-PARTY BENEFICIARY

3.22.1 No person or entity shall be deemed to be a third-party beneficiary of any provision(s) of this Contract; nor shall any provision(s) hereof be interpreted to create a right of action or otherwise permit anyone not a signatory party to the Contract to maintain an action for personal injury or property damage.

ARTICLE 4 – ARCHITECT

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.2 Administration of the Contract

Delete Section **4.2.2** in its entirety and substitute the following:

4.2.2 The Architect, as a representative of the Owner, will visit the site at intervals appropriate to the stage of the Contractor's operations (1) to become generally familiar with and to keep the Owner informed

about the progress and quality of the portion of the Work completed, (2) to endeavor to guard the Owner against defects and deficiencies in the work, and (3) to determine in general if the work is being performed in a manner indicating that the work, when fully completed, will be in accordance with the Contract documents. The Architect will be required to make on-site inspections as necessary to keep the Owner informed of the progress of the Work and as necessary to guard the Owner against defects and deficiencies in the Work. The Architect will neither have control over or charge of, no be responsible for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

Delete Section **4.2.6** in its entirety and substitute the following:

4.2.6 The Architect shall have authority to reject Work that does not conform to the Contract Documents. The Architect shall be required to promptly notify the Owner of any non-conforming Work and shall reject such non-conforming Work unless the Owner objects to the rejection in writing within twenty-four (24) hours of such notification. Whenever the Architect considers it necessary or advisable for implementation of the intent of the Contract documents, the Architect will have authority to require inspection or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. Performance of any additional inspection or testing, which would result in additional cost to the Owner, shall require advance notice to and approval of the Owner. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work, except when the Contractor's inability to perform the Work is a result of design flaw, error or omission.

Add the following Section **4.2.8.1**:

4.2.8.1 Allowance Expenditure will be authorized using Allowance Expenditure authorizations (AEA) executed by the Owner, the Architect and the Contractor. All Allowance Expenditure Authorizations, if not already within Contract, will be incorporated into the contract by Change Order at the completion of the project. Work authorized by an AEA may be invoiced as it is completed.

Delete Section **4.2.13** in its entirety and substitute the following:

4.2.13 All decisions on matters relating to aesthetic effect shall initially be made by the Architect; however, all such decisions are subject to the Owner's written approval.

ARTICLE 5 – SUBCONTRACTORS

5.1 DEFINITIONS

At the end of Section **5.1.1** add the following sentence:

Wherever relevant, the term "Subcontractor" shall also include a person, or entity who supplies material or equipment for the Project.

At the end of Section **5.2.4**, add the following sentence:

Prior to such change the Contractor shall notify the Architect of his intent and reasons for such proposed changes.

5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

Delete the last sentence of Section **5.4.1** in its entirety and substitute the following:

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract, but only to the extent permitted by law. Delete the last sentence of Section **5.4.3** in its entirety.

ARTICLE 7 -- CHANGES IN THE WORK

7.1 GENERAL

Delete the text of Section **7.1.2** in its entirety and substitute the following:

7.1.2 A Change Order shall be based on agreement among the Owner, Contractor, and Architect, except when the Contract balance is amended as a result of Owner's Right to Carry out the Work under Section 2.4.1 or the Owner's assessment of liquidated damages as allowed by the Contract Documents.

A Construction Change Directive requires agreement by the Owner or the Owner's representative and Architect, and may or may not be agreed to by the Contractor; an order for a minor change may be issued by the Architect alone.

Add Section **7.5** as follows:

7.5 ALLOWABLE MARKUPS FOR CHANGES IN THE WORK

7.5.1 If the Change provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;

.2 Unit prices stated in the Contract Documents or subsequently agreed upon;

.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or

.4 As provided in Section 7.5.2 through 7.5.6

7.5..2 Unless otherwise directed, the procedure and markup of the costs for additional work shall be determined in the following manner:

.1 Upon Change Proposal request, the Contractor shall quote the cost for changes in the work showing separately, credits and additional costs broken down by headings used in the Schedule of Values. Further breakdown into units of labor and materials may be required if agreement on cost cannot be reached using the breakdown by headings. The final cost shall be the amount of the Total Contract Value Change shown on the Change Proposal signed by the Contractor and Owner. For general construction work, not subcontracted, the Contractor shall consider as costs the actual invoice amount for additional materials, the sales tax on additional materials when applicable, the wages paid for additional direct labor, plus the Contractor's usual markup of wages to cover additional labor related costs such as insurance, taxes and fringe benefits.

.2 On changes executed within the Owner's Contingency Allowance, Contractor's Contingency Allowance, or other allowances contained within the contract, Contractor shall have included costs for combined overhead and profit, to the extent permitted by the Contract Documents, and General Conditions costs, including the cost of superintendents, field office expense, temporary facilities and services, small hand tools, construction equipment not specifically provided for the change in hand, home office expense, bond and building insurance premiums, and managing the Subcontractor's work, in his Base Contract amount. Allowed overhead and profit fee on Owner's Contingency Allowance changes to be incl uded in the total cost to the Owner shall be based as follows:

.1 For each Subcontractor or Sub-subcontractor involved, for Work performed by that Subcontractor's of Sub-subcontractor's own forces, a maximum of fifteen percent (15%) of the cost.

.2 For each Subcontractor, for Work performed by the Subcontractor's Sub-subcontractors, a maximum of five percent (5%) of the amount due the Sub-subcontractors.

7.5.3 If any additional Work is authorized outside of or in excess of the Owner's Contingency Allowance, the combined overhead and profit for this work shall be based as follows:

.1 For the Contractor, for Work performed by the Contractor's own forces, a maximum total markup of ten percent (10%) of the actual cost on a lump sum project, or the Contractor's Construction Phase Fee on a Guaranteed Maximum Price Project.

.2 For Work performed by the Contractor's Subcontractor(s), a maximum of five percent (5%) of the amount due the Subcontractor(s).

.3 For each Subcontractor or Sub-subcontractor involved, for work performed by that

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ubcontractor's or Sub-subcontractor's own forces, a maximum markup of ten percent (10%) of the actual cost.

.4 For each Subcontractor, for work performed by the Subcontractor's Sub-subcontractors, a maximum of five percent (5%) of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance

with Section 7.3.4

7.5.4 In order to facilitate checking of quotations for extras or credits, all proposals, (except those so minor that their propriety can be seen by inspection), shall be accompanied by a complete and detailed itemization of costs including labor, materials, and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change be approved without such itemization.

7.5.5 Change orders, as they are accepted by the Owner, shall be entered under heading "Change Orders" in the next current Request for Payment.

7.5.6 All credits to or deductions from the Contract Sum, a Contingency or an Allowance shall be calculated using the same methodology set forth in this Section 7.5. All unused Contingency or Allowance amounts shall be credited back to Owner prior to final payment, along with any markups included in the Contract Sum or GMP on such unused amounts.

ARTICLE 8 -- TIME

8.1 DEFINITIONS

At Section **8.1.4**, add the following sentence:
See further definition of "Day" in Section **1.9.10**.

8.3 DELAYS AND EXTENSIONS OF TIME

Delete Section **8.3.1** in its entirety and substitute the following:

8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other unforeseeable causes beyond the Contractor's control, or by other causes which the Architect determines may justify delay, then the Contract Time shall be extended by

Change Order for such reasonable time as the Architect may determine. **No extensions of the Contract Time will be granted for inclement weather, except for Force Majeure weather events consisting of named storms or government declared emergencies resulting from extreme weather.**

Add Sections **8.3.4** and **8.3.5** as follows:

8.3.4 The parties hereto agree that time is of the essence of this Contract and that pecuniary damages would be suffered by the Owner if the Contractor does not substantially complete all Work called for in the Contract Document by the specified date, which damages are, by their very nature, difficult of ascertainment. It is therefore expressly agreed, as a part of the consideration inducing the Owner to execute this Contract that the Owner may deduct from the final payment made to the Contractor a sum equal to **One Thousand Dollars ($1,000.00)**, per phase for each and every Calendar Day beyond the agreed date which the contractor has agreed to for Substantial Completion of the Work included in the Contract Documents. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Work is not substantially completed within the agreed time, or with the legally extended time, if any, otherwise provided for herein. Said sum shall be considered as liquidated damages only, and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. The liquidated damages assessed herein shall be Owner's sole remedy for time delays between the deadlinefor
substantial completion and Contractor's achievement of substantial completion.

8.3.5 Failure to complete and close-out the Project, and complete all Punch List items, withinsixty (60) days after the scheduled Substantial completion date will additionally entitle the Owner to deduct from the final payment made to the Contractor a sum equal to **One Thousand Dollars ($1,000.00)**, per phase,

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or each and every Calendar Day beyond the 60-day close-out period. It is expressly understood that said sum per day is agreed upon as a fair estimate of the pecuniary damages which will be sustained by the Owner in the event that the Project close-out does not occur on a timely basis. Said sum shall be considered as liquidated damages only and in no sense shall be considered a penalty or forfeiture; said damage being caused by additional compensation to personnel, and other miscellaneous increased costs, all of which are difficult of exact ascertainment. If the Contractor is delayed through no fault of the Owner, the Substantial

Completion is not achieved by the agreed contract completion date, the Project close-out period of sixty (60) days will not be extended by the number of days of delay past the actual Substantial completion date and will remain based upon the agreed contract completion date.

ARTICLE 9 -- PAYMENTS AND COMPLETION

9.1 CONTRACT SUM

Add Section **9.1.1.1** as follows:

9.1.1.1 The Owner is exempt from payment of Texas State Sales Tax on materials required for the Work. Therefore, to comply with the law, the Contract Sum shall be broken down into the amount of cost for labor and the amount of cost for materials. This breakdown shall be provided by the Contractor within ten (10) days of award of Contract.

9.2 SCHEDULE OF VALUES

Add the following Sections:

9.2.1 General Contractor's cost for Contractor's fee, bonds and insurance, Individual General Conditions, etc., shall be listed as individual line items.

9.2.2 Schedule of Values shall break each line into materials and labor. Once approved by the Owner and Architect, it shall be used as basis for reviewing Application for Payment but not be taken as evidence of market or other value.

9.2.3 Contractor's cost for various construction items shall be detailed. For example, concrete work shall be subdivided into footings, grade beams, floor slabs, paving, etc. These subdivisions shall appear as individual line items**.**

9.2.4 On major subcontracts, such as mechanical, electrical, and plumbing, the Schedule shall indicated line items and amounts in detail, (for example; underground, major equipment, fixtures, installation of fixtures, start up, etc.)

9.2.5 Costs for subcontract work shall be listed without any addition of General Contractor's costs for overhead, profit or supervision.

9.2.6 The Contractor shall include a value for the coordination documents/drawings on the schedule of values.

9.2.7 The Contractor shall include a value for the correction of deficiencies noted by the Commissioning Agent and the Test, Adjust and Balance consultant on the schedule of values for each sub-contractor subject to commissioning and test, adjust and balance requirements.

9.3 APPLICATIONS FOR PAYMENT

Delete Sections **9.3.1** and **9.3.2** in their entirety and replace them with the following:

9.3.1 Refer to Section 7.1.3 of the A133 Agreement for timelines related to Applications for Payment.

9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders.

9.3.2 Payments will be made on account of materials or equipment 1) incorporated in the Work; 2) suitably stored at the site; or 3) suitably stored at some off-site location, provided the following conditions are met for off-site storage:

.1 The location must be agreed to, in writing, by the Owner and Surety.

.2 The location must be a bonded warehouse.

.3 Surety must agree, in writing, to each request for payment.

.4 The Contractor must bear the cost of the Owner's and Architect's expenses related to visiting the offsite storage area for confirmation.

Payments for materials or equipment stored on or off the site shall be conditioned upon submission by the Contractor of bills of sale or such other procedures satisfactory to the Owner to establish the Owner's title

to such materials or equipment or otherwise protect the Owner's interest, including applicable insurance (naming the Owner as insured) and transportation to the site for those materials and equipment stored off the site. Under no circumstances will the Owner reimburse the Contractor for down payments, deposits, or other advance payments for materials or equipment, without prior written approval of Owner.

The Contractor acknowledges that the review of materials and/or equipment stored off the side is an additional service of the Architect, and the Contractor shall be charged for that service. The cost for such service will be established by the Architect and is not subject to appeal.
Add Section **9.3.4** as follows:

9.3.4 The Contractor shall submit requests for payment, using AIA Document G702, Application and Certificate of Payment, as the cover sheet. Continuation sheets showing in detail the amounts requested, etc., shall be submitted using AIA Document G703, Continuation Sheet, or a computerized version of these documents previously approved for use. The information provided on the continuation sheets in the Description of the Work and Scheduled Values columns shall match the corresponding information shown on the approved Schedule of Values. All blank spaces on AIA Document G702,

Application and Certificate of Payment, must be completed and the signatures of the Contractor and Notary Public shall be original on each form. By submitting his application for payment, the Contractor certifies that the individual signing the application is authorized to do so.

9.6 PROGRESS PAYMENTS

Delete Section **9.6.1** in its entirety and substitute the following:

9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make progress payments in accordance with the following Section and Section 7.1.3 of the A133.

.1 Based upon the applications for payment and supporting documents submitted to the Architect by the Contractor and certification of the amount payable by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided in the Contract Documents for the period covered by the application for payment:

.2 Applications for Payment shall be submitted by the last day of the month. Not later than the last day of the following month, ninety-five percent (95%) of the portion of the Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-five percent (95%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing (subject to the conditions listed in Article 9.3.2 of the Supplementary Conditions to the Contract for Construction), for the period covered by the Application for Payment, less the aggregate of previous payments made by the Owner.

.3 Upon Substantial Completion of the entire Work, a sum sufficient to increase the total payments to ninety-five percent (95%) of the Contract Sum, less such amounts as the Architect shall determine for all incomplete Work and unsettled claims as provided in the Contract Documents.

At Section **9.6.2**, insert the following sentence between the first and second sentence:
More specifically, if only five percent (5%) retainage is withheld by the Owner on payments to the Contractor, then the Contractor shall withhold only five percent (5%) retainage on payments to subcontractors; and subcontractors shall withhold only five percent (5%) retainage on payments to sub-subcontractors.

9.7 FAILURE OF PAYMENT

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elete the phrase “or awarded by binding dispute resolution.” Replace all references to “seven days” to “ten days.”

9.8 SUBSTANTIAL COMPLETION

At Section **9.8.2**, add the following sentence at the end:
Should the Architect determine that the Contractor’s List of Items to be Completed or Corrected lacks sufficient detail or requires extensive supplementation, the list will be returned to the Contractor for revision, and inspection for determining the Date of Substantial Completion will be delayed until the List submitted

is a reasonable representation of the work to be done.

Add Sections **9.8.6** and **9.8.7** as follows:

9.8.6 In order for the project or a major portion thereof to be considered substantially complete, the following conditions must be met:

.1 All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.

.2 All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner’s opinion, cause interference to the Owner’s use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.

The following items are a partial specific list of requirements, as applicable to the Project, that must be completed prior to established Substantial Completion of all portions of the work (Including the Substantial Completion of the commissioning phase).

1. All fire alarm system components must be completed and demonstrated to the Owner.
2. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
3. All exterior clean-up and landscaping must be complete.
4. All final interior clean-up must be complete.
5. All HVAC air and water balancing must be complete.
6. All required commissioning must be complete.
7. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
8. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
9. All final lockset cores must be installed and all final Owner directed keying completed.
10. All roomplaques and exterior signage must be completed.
11. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
12. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.

9.8.7 After the date of Substantial Completion of the Project is evidenced by the Certificate of Substantial Completion, the Contractor will be allowed a period of time within which to correct all deficiencies attached to the Certificate of Substantial Completion as outlined in Section 8.3.4 of these supplementary conditions. Failure of the Contractor to complete such corrections within the stipulated time will be reported to the contractor’s surety. In this report, the Contractor and surety will be informed that, should correction remain incomplete for fifteen (15) days, the Owner may initiate action to complete corrective work out of the remaining Contract funds in accordance with Article 14.2.

.1 Should corrective work following Substantial Completion require more than one reinspection after notification by the Contractor that corrections are complete, the cost of subsequent inspections may also be deducted from the Contract funds remaining unpaid to

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he Contractor.

9.10 FINAL COMPLETION AND FINAL PAYMENT

At Section **9.10.2**, add the following sentence **at the end**:
Prior to final payment, the Contractor shall meet all of the requirements of Owner's Closeout Procedures.

Add Section **9.10.6** as follows:
9.10.6 Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be paid by the Owner to the Contractor, provided the Work has then been completed, the Contract fully performed, all

Contract Close Out Documents have been submitted, the Final Certificate for Payment has been issued by the Architect and Board of Trustees has accepted the Project as complete. The final payment will not be made until all of these conditions have been satisfied.

ARTICLE 10 -- PROTECTION OF PERSONS AND PROPERTY

Add Sections **10.2.9** and **10.2.10** as follows:
10.2.9 The performance of the foregoing services by the Contractor shall not relieve the Subcontractors of their responsibilities for the safety of persons and property and for compliance with all applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to the conduct of the Work.
10.2.10 The Contractor shall be responsible for taking all precautions necessary to protect the Work in place from any foreseeable weather conditions which could cause any potential damage to portions or all Work in place. The Contractor shall be responsible for performing all repairs and/or replacement of any Work that results from foreseeable weather conditions.

10.3 HAZARDOUS MATERIALS

Delete the text of Section **10.3.1** in its entirety and substitute the following:
10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Section 10.3.2.
Delete the text of Sections **10.3.3, 10.3.4** and **10.3.5** in their entirety. Delete the text of Section **10.3.6** in its entirely and substitute the following:
10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a governmental agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all costs and expenses thereby incurred, but only to the extent provided by law.
Add Section **10.3.7** as follows:
10.3.7 As part of the construction contract close out process, and prior to receiving payment of any of the retainage, the Contractor and his subcontractors shall submit notarized statements pertaining to the above referenced hazardous materials.

ARTICLE 11 -- INSURANCE AND BONDS

Delete the text of Sections 11.1 through 11.5 and substitute the following Sections:

11.1 CONTRACTOR'S LIABILITY INSURANCE

The Owner reserves the right to review the insurance requirements during the effective period of any Contract to make reasonable adjustments to insurance coverages and limits when deemed reasonably prudent by Owner based upon changes in statutory laws, court decisions or potential increase in expense to loss.

11.2 The Owner requires the following minimum insurance coverages:

Types of Coverage		Limits of Liability
Commercial General Liability	General Aggregate	$2,000,000.00
	Products/Completed Operations/Aggregate	$1,000,000.00
	Bodily Injury and Property Damage (each)	$1,000,000.00
	Contractual	$1,000,000.00
	Personal and Advertising Injury	$1,000,000.00
	Fire Damage	$500,000.00
	Medical Expense	$5,000.00

11.2.1 The Owner shall be named as an additional insured on a primary and non-contributory basis using form CG 2010 10 01 or similar endorsement providing equal or greater coverage in favor of the Owner.

Coverage shall include the following:

(a) Premises operations;
(b) Blanket Contractual Liability;
(c) Pollution;
(d) Products/Completed Operations;
(e) Broad Form Property Damage;
(f) Independent Contractors;
(g) Per project aggregate limit;
(h) Provide a statement of claims against the aggregate limit with each renewal certificate
(i) X,C,U exclusions to be removed when underground work is performed; and
(j) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided

11.2.2 Automobile Liability — Combined Single Limit — $1,000,000.00

(a) Comprehensive Automobile Liability Insurance to cover all vehicles owned by, hired by, or used on behalf of Contractor.
(b) Owner and its officers, directors, representatives, agents and employees shall be endorsed as Additional Insureds, as their interests may appear.
(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.2.3 Workers' Compensation — Statutory Limits

(a) Coverage at Statutory Limits with All States Endorsement
(b) Employer's Liability

Each Accident	$1,000,000.00
Disease (Policy Limit)	$1,000,000.00
Disease (Each Employee)	$1,000,000.00

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents and employees shall be provided.

11.2.4 Excess or Umbrella Insurance (provides coverage in excess of primary Commercial General Liability, Automobile Liability, and Worker's Compensation Coverage B limits)

(a) Minimum coverage for the Contractor shall be one (1) times the Contract amount, subject to a minimum limit of $1,000,000.00 and a maximum limit of $25,000,000.00. Limits for primary policies may differ from those shown above when Excess (Umbrella) Insurance coverage is provided.
(b) Owner and its officers, directors, representatives, agents and employees shall

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e endorsed as Additional Insureds, as their interests may appear.

(c) Waivers of subrogation in favor of Owner and its officers, directors, representatives, agents, and employees shall be provided.

11.3 The Owner requires that the following insurance requirements be satisfied:

.1 No Work shall be commenced until all insurance requirements set forth in this Agreement have been approved by the Owner in writing.

.2 All insurance policies and certificates required hereunder shall be in form and content satisfactory to the Owner.

.3 The Owner shall be furnished an ACORD form Certificate of Insurance evidencing all policies and endorsements required by this Agreement prior to execution of the Contract and thereafter upon renewal or replacement of each required policy of insurance.

.4 Each Insurance coverage/policy shall contain a provision that at least thirty (30) days prior written notice shall be given to the Owner in the event of cancellation, material change, or non-renewal.

.5 Insurance shall be underwritten by a company licensed to do business in Texas, satisfactory to Owner and rated minimum A-VII by A.M. Best.

.6 The insurance coverages specified herein shall be maintained at all times during the term of the contract and, with the exception of builder's risk coverage, shall be maintained for a minimum of one (1) year thereafter.

.7 No deletions/exclusions from the standard coverage form are allowed without the prior written consent of the Owner.

.8 All insurance must be issued on an occurrence basis.

.9 The Contractor shall be responsible for all deductibles; the Owner shall approve the deductibles selected.

.10 With the exception of Excess Umbrella Coverage, the coverage afforded by each carrier must be a primary over any other applicable insurance.

.11 In addition to certificates of insurance, copies of policy endorsements must be provided (a) listing the Owner as Additional Insured, and (b) showing waivers of subrogation in favor of the Owner.

11.4 PERFORMANCE BOND AND PAYMENT BOND

Add the following Sections:

11.4.1 The Contractor shall provide a Performance Bond, in the penal sum equal to one hundred percent (100%) of the Contract Sum, if the formal Contract is in excess of One Hundred Thousand Dollars ($100,000.00) and a Labor and Material Payment bond, in the penal sum equal to one hundred percent (100%) of the Contract sum if the formal contract is in excess of Twenty Five Thousand Dollars ($25,000.00).

11.4.2 The Work will not be started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an attached authorized power of attorney. Such Bonds shall be issued by a company authorized to do business in the State of Texas with an A.M. Best Company rating of a least A-X and included on the U.S. Department of the Treasury Listing of Approved Sureties (Dept. Circular 570).

11.4.3 The Performance Bond Form and the Payment Bond Form included herein shall be executed and submitted to the Architect in duplicate prior to commencement of the work. The surety companies must be acceptable to the Owner and licensed admitted carriers in the State of Texas; and the companies must appear in a current Federal Treasury list as Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds land as Acceptable Reinsuring companies.

11.4.4 Each bond shall be of penal sum equal to one hundred percent (100%) of the Contract Sum and shall be compatible with the provisions of the governing authority. The Contractor shall file copiesf each bond with the county clerk and furnish the Owner with a file receipt. The bonds shall remain in force throughout the warranty period of the contract. The Work will not

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e started until the bonds and issuing companies have been accepted as satisfactory by the Owner. The original bonds will be delivered to the Owner with an authorized power of attorney attached.

11.4.5 Claims must be sent to the Contractor and his Surety in accordance with Article 5160, Revised Civil Statutes. The Owner will furnish in accordance with such Article, a copy of the Payment Bond as provided therein to claimants upon request. All claimants are cautioned that no lien exists on the funds unpaid to the contractor on such Contract, and that reliance on notices sent to the Owner may result in loss of their rights against the Contractor and/or his Surety. The Owner is not responsible in any manner to a claimant for collection of unpaid bills, and accepts no responsibility because of any representation by any agent or employee.

11.5 WORKER'S COMPENSATION INSURANCE COVERAGE

11.5.1 Comply with the requirements of Rule 28, TAC §110.110, Reporting Requirements for Building or Construction Projects for Governmental Entities

11.5.2 DEFINITIONS:

.1 Certificate of coverage ("certificate"). A copy of a certificate of insurance, a certificate of authority to self-insure issued by the commission, or a coverage agreement (TWCC-81, TWCC-82, TWCC-83, or TWCC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing service as on a project, for the duration of the project.

.2 Duration of the project –includes the time from the beginning of the work on the project until the contractor's/person's work on the project has been completed and accepted by the governmental entity.

.3 Persons providing services on the project ("subcontractor" in §406.096)-includes all persons or entities performing all or part of the services the contractor has undertaken to perform on the project, regardless of whether that person has employees. This includes, without limitation, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity which furnishes persons to provide services on the project. "Services" include without limitation, providing hauling, or delivering equipment or materials, or providing labor, transportation, or otherservice related to a project. "Services" does not include activities unrelated to the project, such as food/beverage vendors, office supply delivery, and delivery of portable toilets.

11.5.3 The Contractor shall provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meets the statutory requirements of Texas Labor Code, Section 401.011(44) for all employees of the Contractor providing services on the project, for the duration of the project.

11.5.4 The Contractor must provide a certificate of coverage to the governmental entity prior to being awarded the contract.

11.5.5 If the coverage period shown on the Contractor's current certificate of coverage ends during the duration of the project, the Contractor must, prior to the end of the coverage period, file a new certificate of coverage with the governmental entity showing that coverage has been extended.

11.5.6 The Contractor shall obtain from each person providing services on a project, and provide to the governmental entity:

.1 A certificate of coverage, prior to that person beginning work on the projects so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project, and

.2 No later than seven days after receipt by the Contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

11.5.7 The Contractor shall retain all required certificates of coverage for the duration of the

project and for one year thereafter.

11.5.8 The Contractor shall notify the governmental entity in writing by certified mail or personal

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elivery, within 10 days after the Contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project.

11.5.9 The Contractor shall post on each project site a notice, in the text, form and manner prescribed by the Texas Worker's Compensation, informing all persons providing services on the project that they are required to be covered, and stating how a person may verify coverage and report lack coverage.

11.5.10 The Contractor shall contractually require each person with whom it contracts to provide services on a project, to:

.1 Provide coverage, based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements, which meet the statutory requirements of Texas Labor code, Section 401.011(44) for all of its employees providing services on the project, for the duration of the project.

.2 Provide the Contractor, prior to that person beginning work on the project, a certificate of coverage showing that coverage is being provided for all employees of the person providing services on the project, for the duration of the project.

.3 Provide the Contractor, prior to the end of the coverage period shown on the current certificate ends during the duration of the project.

.4 Obtain from each other person with whom it contracts, and provides to the Contractor:
.1A certificate of coverage, prior to the other person beginning work on the project, and
.2A new certificate of coverage showing extension of coverage, prior to the end of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project.

.5 Retain all required certificates of coverage on file for the duration of the project and for one year thereafter.

.6 Notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project, and

.7 Contractually require each person with whom it contracts, to perform as required by these subsections (1)-(7), with the certificates of coverage to be provided to the person for whom they are providing services.

11.5.11 By signing this Contract or providing or causing to be provided a certificate of coverage, the Contractor is representing to the governmental entity that all employees of the Contractor who will provide services on the project will be covered by workers compensation coverage for the duration of the project, that the coverage will be based on proper reporting of classification codes and payroll amounts, and that all coverage agreements will be filed with the appropriate insurance carrier or, in the case of a self-insured, with the commission's Division of Self-Insurance Regulation. Providing false or misleading information may subject the Contractor to administrative penalties, criminal penalties, civil penalties, or other actions.

11.5.12 The Contractor's failure to comply with any of these provisions is a breach of contract by the Contractor which entitles the governmental entity to declare the contract void if the Contractor does not remedy the breach within ten days after receipt of notice of breach from the governmental entity.

ARTICLE 12—UNCOVERING AND CORRECTION OF WORK

12.2.1 BEFORE SUBSTANTIAL COMPLETION

After Section **12.2.1** add the following Sections:

12.2.1.1 In the event of failure of a specified project, either during construction or the correction period, the Contractor shall take appropriate measures with the manufacturer of the product to assure correction or replacement of the defective products.

12.2.1.2 Refer to Owner's Closeout Procedures for further terms regarding warranties which will be required prior to final payment.

12.2.2 AFTER SUBSTANTIAL COMPLETION

After Section **12.2.2.1** add the following Section:

12.2.2.1.1 Approximately eleven months after substantial completion, the contractor shall accompany the Owner and Architect on an "end of the one year correction period" reinspection of the Project. Additional deficiencies observed or reported shall be corrected by the Contractor.

12.3 ACCEPTANCE OF NONCONFORMING WORK

Number the existing provision as Section **12.3.1**, and add Section **12.3.2** as follows:

12.3.2 The Owner's use and/or occupancy of any or all of the Project site shall never be construed as an acceptance of Work not in conformance with Contract Documents. The Owner reserves the right to enforce provisions of the Contract unless the Owner's acceptance is provided to the Contractor in writing.

ARTICLE 13—MISCELLANEOUS PROVISIONS

Add Sections **13.6**, **13.7 and 13.8** as follows:

13.6 EQUAL OPPORTUNITY

13.6.1 The contractor shall maintain policies of employment as follows:

.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

13.7 CRIMINAL BACKGROUND CHECKS

The Contractor/Subcontractor shall certify that all employees' fingerprints and information necessary for the Criminal Background Check has been submitted to DPS, as stated in the form included herein, as required by Texas Education Code Section 22.08341 and Texas Administrative Code Section 153.1101 and 153.1101(7), and shall comply with all requirements of such laws in the event Owner notifies Contractor/Subcontractor that such Crimianl Background Check reflects offenses prohibited by law.

13.8 REQUIRED CERTIFICATIONS

Contractor hereby certifies that it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization

designated as a Foreign Terrorist Organization by the U.S. Secretary of State under federal law. Contractor

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ereby certifies and verifies that neither Contractor, nor any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), boycotts Israel, and contractor agrees that Contractor and Contractor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include terminating business activities or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory.

Contractor hereby represents and warrants that: (1) it does not, and will not for the duration of the contract, boycott energy companies or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

Contractor hereby represents and warrants that: (1) it does not, and will not for the duration of the contract, have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association or (2) the verification required by Section 2274.002 of the Texas Government Code does not apply to the contract.

ARTICLE 14—TERMINATION OR SUSPENSION OF THE CONTRACT

Delete the text of Section 14.1.3 in its entirety and substitute the following:

14.1.3 If one of the reasons described in Section 14.4.1 or 14.4.2 exists, the Contractor may, upon seven day's written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed as of the date of the notice, plus costs ofdemobilization.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

Delete the text of Section **14.4.3** in its entirety and substitute the following:

14.4.3 In the case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed up to date of receipt of the notice of termination, plus costs of demobilization.

ARTICLE 15—CLAIMS AND DISPUTES

15.1 CLAIMS

Delete the text of Section **15.1.1** in its entirety and substitute the following:

15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner, Architect, and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. Nothing herein shall require the Owner to make or file a Claim in order to assess liquidated damages provided for in the Contract Documents.

15.1.2 TIME LIMITS ON CLAIMS

Delete the last sentence of Section **15.1.2** in its entirety.

15.1.3 NOTICE OF CLAIMS

Delete the second sentence of Section **15.1.3** in its entirety and substitute the following:

Claims by either party must be initiated within ninety (90) days after occurrence of the event giving riseto such Claim or within ninety (90) days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

15.1.6 CLAIMS FOR ADDITIONAL TIME

Delete the text of **Section 15.1.6.2** in its entirety and substitute the following:

15.1.6.2 **No extensions of the Contract Time will be granted for inclement weather, except as provided in Section 8.3.1.**

15.1.7 CLAIMS FOR CONSEQUENTIAL DAMAGES

Delete the text of Section **15.1.7** in its entirety.

15.2 INITIAL DECISION

Delete the text of Section **15.2.1** in its entirety and substitute the following:

15.2.1 Claims, excluding those alleging an error or omission by the Architect or those arising after expiration of the period for correction of the Work, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. If the parties are unable to agree, any claim, dispute or matters arising out of the contract between the Architect, Owner and Contractor or any combination of those parties shall be submitted to a court of appropriate jurisdiction.

Delete the text of Section **15.2.5** in its entirety and substitute the following:

15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefore; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties, but subject to mediation, if both parties so agree, and subject to legal or equitable proceedings in a court having jurisdiction thereof. It is understood and agreed that, in the event that any dispute, controversy, or conflict arises during the design and construction of the Project or following its completion, the parties hereto will cooperate in good faith, if possible, to resolve the issues without resorting to litigation.

Delete the text of Sections **15.2.6** and **15.2.6.1** in their entirety.

Add the following Section **15.2.9**

15.2.9 The prevailing party in any judicial proceeding arising from the Contract Documentsshall recover its reasonable and necessary attorneys' fees.

15.3 MEDIATION

15.3.1 Delete the text of **15.3.1** in its entirety.

Delete Section **15.3.2** in its entirety and replace with the following:

15.3.2 The parties may mutually agree to resolve their claims by mediation which, unless the parties mutually agree otherwise, shall be in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect. Request for mediation shall be filed in writing with the other party to the Contract. Mediation shall proceed in advance of legal or equitable proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing unless stayed for a longer period of agreement of the parties or court order.

15.4 ARBITRATION

Delete the text of Sections **15.4.1** through **15.4.3** and **15.4.4.1** through **15.4.4.3** in their entirety.

END OF SECTION 00 73 00

SECTION 00 73 19
SAFETY REQUIREMENTS

A. This section applies to all Contractor's personnel, including but not limited to Subcontractors, Sub-subcontractors, vendors, suppliers, and inspectors.

B. The following Safety Requirements are to be adhered too on all Lamar CISD Projects along with OSHA requirements and all required safety regulations. Where there is a conflict, the most stringent requirement shall govern.

C. OSHA Requirements:
1. Conform to OSHA Requirements of 29CFR 1926 & applicable sections of 29CFR1910
2. Conform to all State and Local Regulations and Requirements that are applicable

D. Above OSHA Requirements:
1. Accident Reporting – Must be timely and properly documented within 24 hours of the accident or incident.
2. "Baker" Scaffolding – Guardrail required at 4'-0" above working surface.
3. Clothing – Shirts with sleeves, long pants, substantial work shoes or boots, no vulgar or inappropriate shirts are allowed.
4. Confined Spaces – Procedures, testing, and training in accordance with OSHA 1910.146
5. Controlled Substances (including alcohol) are prohibited on the job site.
6. Cranes – Independent 3rd party inspection by an agency accredited by USDOL, OSHA under the regulations of Title 29, Chapter XVIII, Part 1919
7. Discipline Program –Verbal Warning, Written Warning, Dismissal
8. Electrical Cords and Tools –Assured Equipment Grounding Program required
9. Emergency Procedures – Compliance mandatory
10. Fall Protection (Steel Erection) 100% Tie off shall be the primary means of fall protection
11. Fall Protection (Precast Concrete) 100% Tie off shall be the primary means of fall protection.
12. Fall Protection 9A written fall protection program will be required of all contractors
13. Fighting – Prohibited on the job site; offenders shall be dismissed immediately.
14. Hazard Communication – Haz Com Program and Material Safety Data Sheets are required
15. Hot Work – Permits and a dedicated Fire Watch required for all operations.
16. Housekeeping – Combustible scrap materials & debris must be removed daily.
17. Immediate Danger to Safety or Health – Work shall be stopped immediately.
18. Job Hazard Analysis – Must be created prior to mobilization and strictly followed for all work.
19. Orientation Session – All Employees must attend before starting work at any project site.
20. Personal Protective Equipment – Hard Hats & Safety Glasses required at all times.
21. Return to Work – Restricted Duty to be made available to the extent allowed by the doctor.
22. Safety Representative – Must meet requirements of the Competent Person Standard and have completed an OSHA 10 hour construction outreach training.
23. Scaffolding – Inspection & Documentation required daily by a Competent Person.
24. Training – Weekly "Tool-Box" Safety meetings to be performed with a signed attendance roster.
25. Weapons – Possession of weapons on the project site is prohibited.
26. Lamar CISD strictly enforces "No Tobacco Products" on school property.

E. Site Safety Orientation

1. The Contractor shall perform site safety orientation with all employees working on the Project prior to their beginning any work. In addition to the above safety requirements, the following criteria shall be addressed and emphasized in the orientation. A log of each employee's attendance with signature of participant and employer shall be kept and made available to the Owner and Architect at all times.

2. Emphasis shall be placed on protection of the students:
   a. School speed zones
   b. Access to building, badges, stickers, etc.
   c. No over head work when children are present.
   d. No Alcohol/drugs/guns on premises
   e. Times when students arrive/leave to co-ordinate construction activities

3. Do's and Don'ts for the construction worker covering topics, such as:
   a. Proper clothing (no explicit words/pictures/sayings)
   b. Proper footwear
   c. Material Safety Data Sheets
   d. Fall Protection
   e. Housekeeping
   f. Gloves
   g. Respiratory protection, etc

By signature of this document, I hereby state that I (or designated representative of this Company as indicated below) have reviewed the project sites, reviewed the Contract Documents and read the Specifications including the General Conditions, Supplementary Conditions and Special Owner Requirements in their entirety and do fully understand and agree to fully abide by all requirements established herein.

Respectively Submitted,

By:

_____
Signature

_____
Name

_____
Title

_____
Company Name

_____
Street Address

_____
City, State, Zip Code

(Seal - if Proposer is a corporation)

NOTE: Form must be notarized and attached to the Construction Contract.

THIS DOCUMENT MUST BE EXECUTED AND SUBMITTED WITH EXECUTED CONTRACT

END OF SECTION 00 73 19

Prevailing Wage Rate
Determination Information

The following information is from Chapter 2258 Texas Government Code:

Sec. 2258.021. Right to be Paid Prevailing Wage Rates.

(a) A worker employed on a public work by or on behalf of the state or a political subdivision of the state shall be paid:
    (1) not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which the work is performed; and
    (2) not less than the general prevailing rate of per diem wages for legal holiday and overtime work.
(b) Subsection (a) does not apply to maintenance work.
(c) A worker is employed on a public work for the purposes of this section if the worker is employed by a contractor or subcontractor in the execution of a contract for the public work with the state, a political subdivision of the state, or any officer or public body of the state or a political subdivision of the state.

Sec. 2258.023. Prevailing Wage Rates to be paid by Contractor and Subcontractor; Penalty.

(a) The contractor who is awarded a contract by a public body or a subcontractor of the contractor shall pay not less than the rates determined under Section 2258.022 to a worker employed by it in the execution of the contract.
(b) A contractor or subcontractor who violates this section shall pay to the state or a political subdivision of the state on whose behalf the contract is made, $60 for each worker employed for each calendar day or part of the day that the worker is paid less than the wage rates stipulated in the contract. A public body awarding a contract shall specify this penalty in the contract.
(c) A contractor or subcontractor does not violate this section if a public body awarding a contract does not determine the prevailing wage rates and specify the rates in the contract as provided by Section 2258.022.
(d) The public body shall use any money collected under this section to offset the costs incurred in the administration of this chapter.
(e) A municipality is entitled to collect a penalty under this section only if the municipality has a population of more than 10,000.

Sec. 2258.051. Duty of Public Body to Hear Complaints and Withhold Payment.

A public body awarding a contract, and an agent or officer of the public body, shall:

(1) take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and
(2) withhold money forfeited or required to be withheld under this chapter from the payments to the contractor under the contract, except that the public body may not withhold money from other than the final payment without a determination by the public body that there is good cause to believe that the contractor has violated this chapter.

NOTE: Lamar CISD will request certified payroll from trades at random times throughout the life of the project to verify Prevailing Wage Rates compliance.

Prevailing Wage Rates – School Construction Trades

June 1, 2022

Texas Gulf Coast Area

CLASSIFICATION	2022 HOURLY RATE
ASBESTOS WORKER	$22.17
BRICKLAYER; MASON	$25.32
CARPENTER; CASEWORKER	$23.38
CARPET LAYER; FLOOR INSTALLER	$25.12
CONCRETE FINISHER	$23.40
DATA COMM/TELE COMM	$23.50
DRYWALL INSTALLER; CEILING INSTALLER	$27.56
ELECTRICIAN	$25.93
ELEVATOR MECHANIC	$31.13
FIREPROOFING INSTALLER	$22.38
GLAZIER	$22.30
HEAVY EQUIPMENT OPERATOR	$22.33
INSULATOR	$20.50
IRONWORKER	$27.33
LABORER, HELPER	$16.71
LATHERER; PLASTERER	$23.25
LIGHT EQUIPMENT OPERATOR	$20.50
METAL BUILDING ASSEMBLER	$23.25
MILLWRIGHT	$33.63
PAINTER; WALL COVERING INSTALLER	$19.60
PIPEFITTER	$26.97
PLUMBER	$26.71
ROOFER	$20.50
SHEET METAL WORKER	$21.67
SPRINKLER FITTER	$26.13
STEEL ERECTOR	$23.25
TERRAZZO WORKER	$23.50
TILE SETTER	$19.58
WATERPROOFER; CAULKER	$19.88

This document was developed by PBK Architects, Inc., in strict accordance with Chapter 2258 of the Texas Government Code.

Prevailing Wage Rates

Worker Classification Definition Sheet

CLASSIFICATION	DEFINITION
ASBESTOS WORKER	Worker who removes and disposes of asbestos materials.
BRICKLAYER; MASON	Craftsman who works with masonry products, stone, brick, block, or any material substituting those materials and accessories.
CARPENTER; CASEWORKER	Worker who build wood structures or structures of any material which has replaces wood. Includes rough and finish carpentry, hardware and trim.
CARPET LAYER; FLOOR INSTALLER	Worker who installs carpets and /or floor coverings, vinyl tile.
CONCRETE FINISHER	Worker who floats, trowels, and finishes concrete.
DATA COMM/TELE COMM	Worker who installs data/telephone and television cable and associate equipment and accessories.
DRYWALL; CEILING INSTALLER	Worker who installs metal framed walls and ceiling, drywall coverings, ceiling grids, and ceilings.
ELECTRICIAN	Skilled craftsman who installs or repairs electrical wiring and devices. Includes fire alarm systems and HVAC electrical controls.
ELEVATOR MECHANIC	Craftsman skilled in the installation and maintenance of elevators.
FIREPROOFING INSTALLER	Worker who sprays or applies fire proofing materials.
GLAZIER	Worker who installs glass, glazing, and glass framing.
HEAVY EQUIPMENT OPERATOR	Includes but not limited to: all CAT tractors, all derrick-powered, all power operated cranes, back-hoes, back-fillers, power operated shovels, winch trucks, and all trenching machines.
INSULATOR	Worker who applies, sprays, or installs insulation.
IRONWORKER	Skilled craftsman who erects structural steel framing, and installs structural concrete Rebar.
LABORER, HELPER	Worker qualified for only unskilled or semi-skilled work. Lifting, carrying materials or tools, hauling, digging, clean up.
LATHERER; PLASTERER	Worker who installs metal framing and lath. Worker who applies plaster to lathing and installs associated accessories.
LIGHT EQUIPMENT OPERATOR	Includes but not limited to , air compressors, truck crane drivers, flex planes, building elevators, form graders, concrete mixers less than 14cf), conveyers.
METAL BUILDING ASSEMBLER	Worker who assembles pre-made metal buildings.
MILLWRIGHT	Mechanic specializing in the installation of heavy machinery, conveyance, wrenches, dock levelers, hydraulic lifts, and align pumps.
PAINTER; WALL COVERING INSTALLER	Worker who prepares wall surfaces and applies paint and/or wall coverings, tape, and bedding.
PIPEFITTER	Trained worker who installs piping systems, chilled water piping and hot water (boiler) piping, pneumatic tubing controls, chillers, boilers, and associated mechanical equipment.
PLUMBER	Skilled craftsman who installs domestic hot and cold water piping, waste piping, storm system piping, water closets, sinks, urinals, and related work.
ROOFER	Worker who installs roofing materials, Bitumen (asphalt and coal tar) felts, flashings, all types of roofing membranes, and associated products.
SHEET METAL WORKER	Worker who installs sheet metal products, Roof metal, flashings and curbs, ductwork, mechanical equipment, and associated metals.
SPRINKLER FITTER	Worker who installs fire sprinklers systems and fire protectant equipment.
STEEL ERECTOR	Worker who erects and dismantles structural steel frames of buildings and other structures.
TERRAZZO WORKER	Craftsman who places and finishes Terrazzo
TILE SETTER	Worker who prepares wall and/or floor surfaces and applies ceramic tiles to these surfaces.
WATERPROOFER; CAULKER	Worker who applies water proofing material to buildings. Products include sealant, caulk, sheet membranes, and liquid membranes, sprayed, rolled or brushed.

SECTION 01 10 00 MISCELLANEOUS REQUIREMENTS

INDEX PAGE NUMBER

30. COORDINATION

31. OBSERVATION OF THE WORK

32. BUILDING PERMITS, SERVICE TAPS, LICENSES, ETC.

33. COOPERATION WITH BUILDING OFFICIALS

34. PARKING AND STORAGE

35. SAFETY

36. CONSTRUCTION PERSONNEL BACKGROUND CHECKS AND FINGERPRINTING FOR WORK ON OCCUPIED CAMPUSES

37. SCHOOL OPERATIONS/CONSTRUCTION PERSONNEL

38. FENCING, BARRICADES AND WARNINGS

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40. FIELD MEASUREMENTS

41. TESTING AND OPERATION OF MACHINERY

42. WATCHMAN

43. OWNER'S OCCUPANCY

44. MISCELLANEOUS

45. TOXIC AND HAZARDOUS MATERIALS

46. LEAD RENOVATION, REPAIR AND PAINTING RULE (RRP RULE)

47. PROJECT SIGNS

48. WORKER'S COMPENSATION

49. BONDS AND INSURANCE

50. FAILURE TO COMPLETE WORK ON SCHEDULE (LIQUIDATED DAMAGES)

51. DEMOLITION

FORMS REQUIRED TO BE SUBMITTED BY CONTRACTOR AT END OF THIS SECTION

1. **Demolition / Renovation Notification Form – Texas Dept. of State Health Services (SUBMITTED BY OWNER)**
2. **Contractor's Affidavit of Non-Use of Asbestos**
3. **Contractor's Affidavit of Non-Use of Lead**
4. **Subcontractor's / Material Supplier's Affidavit**
5. **Contractor's Affidavit of Non-Use of Urea-Formaldehyde**
6. **Contractor's Affidavit Of Limited Use Of Urea-Formaldehyde For Particleboard Or Medium Density Fiberboard**
7. **Contractor's Affidavit**
8. **Subcontractor Warranty**
9. **Felony Conviction Notification**
10. **Data Required By Senate Bill 9 for National Criminal History Check**

11. Criminal History Check for Contractors
12. Certification Of Project Compliance (Texas Education Agency)

1. RELATED DOCUMENTS

Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

2. SUMMARY

These Miscellaneous Requirements are to supplement the General and Supplementary Provisions of the Contract for Construction, which are included as part of these Contract Documents. Should these Special Conditions conflict with either of the above, the more stringent shall govern.

3. REMOVAL OF DEBRIS

The Contractor shall remove and legally dispose of all debris and unused material off-site. Unless noted otherwise, excess earth and rock-excavated materials shall be removed and disposed of off-site.

4. DRAWINGS AND SPECIFICATIONS

A. The Drawings and Specifications are intended to describe and provide for a finished and complete piece of work, and meeting the requirements of all the applicable and governing laws, ordinances, rules, regulations of the locality is a requirement and all work must meet these requirements.

B. No extra compensation will be allowed for oversight of any such requirements, except by written order issued by the Owner.

C. Should any doubt arise regarding Drawings or Specifications, clarification shall be requested by the Contractor from the Architect only. Failure to do so shall not relieve the Contractor from responsibility to complete the work to the Owner's satisfaction.

D. In accordance with the General Conditions of the Contract, the Drawings and Specifications are complimentary and what is required by one shall be as binding as if required by all. Anything mentioned in the Specifications and not shown on the Drawings, or shown on the Drawings and not mentioned in the Specifications, shall be like effect as if shown or mentioned in both.

E. Should the Drawings disagree in themselves, or with the Specifications, **the better quality and/or greater quantity** of work and/or materials shall be included within the contractor's project proposed pricing, and unless otherwise ordered by the Architect in writing, shall be performed and/or furnished. In case the Specifications should not fully agree with material schedules, the latter shall govern.

5. SPECIFICATIONS

The "Scope of Work", placed in the front part of each Section of the Specifications, is intended to designate the scope and locations of all items of the work included therein, either generally or specifically. It is not, however, intended to limit the scope of the work where plans, schedules, or notes indicate an increased scope.

6. DRAWINGS

A. The general character of the detail work is shown on Drawings, but minor modifications may be made by Architect in full size Drawings, shop drawings, or models. Contractor shall not attempt to execute any part of the work requiring such drawings until he has received approved copies of same.

B. The contract drawings are not designed nor intended to be used as “shop drawings” or “submittal drawings”. The contractor and his sub-contractors are responsible for providing new, proper shop drawings and submittal drawings showing detailed construction means, methods and materials to be reviewed by the architect and consultants.

C. Where the word “similar” or typical” occurs on Drawings, it shall be used in its general sense and not as meaning identical, and all details shall be worked out in relation to their location and their connection to other parts of the work.

D. Small scale and large scale drawings are intended to be mutually explanatory. In case of variance, the following order of preference is established to define the intent of the work:

1. Explanatory notes on Drawings;
2. Figured dimensions;
3. Large scale details;
4. Small scale details;
5. Scale measurements

7. INTERPRETATION OF DOCUMENTS

Bidders on the proposed project, having any doubt as to the meaning of any part of the proposed Contract Documents, shall submit and deliver written requests to the Contractor for interpretation from the Architect at least ten (10) days prior to bid opening time. Interpretations shall then be made by written “Addenda” only, duly issued by the Architect.

8. MATERIALS AND WORK

A. Unless otherwise specified, all materials shall be new and free of asbestos, noxious or toxic fumes, urea-formaldehyde and lead (lead in potable water system), and both workmanship and materials shall be of the best quality, and each Contractor shall, if required, furnish satisfactory evidence as to the kind and quality of his materials and workmanship. Any work installed, which does not meet these requirements of the Contract Documents, shall be removed and replaced by work which is in accordance therewith. The Contractor and subcontractors shall promptly withdraw from the work any workman who proves incompetent or fails to cooperate with other crafts or the Architect to the best interest of the work or anyone not skilled and/or unfit in the work assigned him.

B. The Contractor and subcontractors shall be responsible for the proper care and protection of all his materials, equipment, etc., delivered at the site. When any room in the building is used as a shop, storeroom, etc., all Contractors shall be jointly held responsible for any repairs, patching or cleaning arising from such use.

C. The Contractor and subcontractors shall protect and be responsible for damage to his work from date of Agreement until final payment is made, and shall make good, without cost to the Owner, any damage or loss that may occur during this period. Contractor shall handle all materials, so directed, so that it may be inspected by the Contractor and the Architect. All materials affected by the weather shall be covered and protected to keep them free from damage while being transported to the site; when stored at site, they shall be placed in watertight storage sheds/compartments. Any material damaged by water or other causes shall be removed from the site.

9. INTENT OF THE DOCUMENTS

A. It is the intention of these Contract Documents to cover the complete installation of the various systems and the Contractor is to furnish all items necessary to make the various systems

complete, although each and every item required may not be specifically mentioned in these Specifications or shown on the drawings.

B. Any discrepancies in the Specifications must be reported to the Architect for clarification, correction and interpretation from the Architect/Engineer before the work is executed.

10. EXISTING UNDERGROUND UTILITIES

If existing underground lines occur in the site where the work is to be done, such lines will be located and staked by the Contractor for the benefit of the Owner and the Contractor prior to start of the work. Maintain markings throughout construction period. Prior to excavation review with the Owner the locations of all underground utilities and receive the Owner's "Dig Permit" permission to begin excavation.

11. EXAMINATION OF DOCUMENTS AND SITE

Bidders shall visit the project sites and compare Drawings and Specifications therewith including other work being performed which in any way affects the project. Failure or oversight in any of the above requirements will in no way relieve the successful bidders from responsibility of completing the project in accordance with the drawings and Specifications without additional cost to the Owner.

The Contractor represents and warrants by submission of a proposal that the Contractor has carefully examined the Drawings, Project Manual and the site of the Work and that from the Contractor's own investigations, the Contractor is satisfied as to the nature and location of the Work, the character, quality and quantity of surface and subsurface materials likely to be encountered, the character of equipment and other facilities needed for the performance of the Work or its performance.

No allowance on behalf of the Contractor will be made subsequently by the Owner for any error or negligence on the part of the Contractor not having visited the site, or not having thoroughly studied and compared all of the Construction Documents before submitting a proposal.

12. START OF WORK

Contractor will start work after receiving notice from the Owner/Architect to proceed. Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

13. GRADES, LINES, LEVELS, AND LAYOUT

All grades and lines shall be established and maintained by the Contractor, who shall be responsible for same. Immediately upon starting the project, locate and protect all general reference points, lay out work, and verify all grades, lines, levels, and dimensions as shown on the Drawings and report any errors or inconsistencies to the Architect. Contractor shall be responsible for errors resulting from his failure to do so.

14. PROTECTION OF EXISTING FACILITIES

Contractor shall take precaution to protect existing grounds and facilities from damage. Any damage caused by Contractors shall be repaired immediately.

15. LOCAL REPRESENTATION FOR CONTRACTORS AND SUBCONTRACTORS

Out of town contractors and subcontractors (firms based more than 200 miles from Project site) shall arrange and pay all costs for a representative in this area to handle call-back work during the project guarantee period. This requirement shall not relieve the contractor of his responsibilities as provided elsewhere in the Contract Documents.

16. CONTRACTOR'S SUPERINTENDENT

A competent superintendent initially approved by the Contractor, Architect and Owner shall be kept by the Contractor or Contractors at each building site at all times and in continuous employment during the progress of the work, to receive instructions and to act for the Contractor in the accurate laying out and direction of all work. Once approved and selected, the Contractor shall not replace the General Superintendent without approval of the Owner. The Owner reserves the right to direct any contractor to replace the superintendent for any reason with another subject to Owner's approval.

17. RELATIONSHIP BETWEEN TRADES

The Contractor shall require and be responsible for cooperation and coordination between various Trades and Subcontractors whose work is dependent upon one another. Schedule such work so as to prevent delays in dependent work so that all related work will progress together. Fully inform each Trade or Subcontractor of the relation of his work to other work, and require each to make necessary provisions for the requirements of such other work. No additional compensation for extra work incurred through the lack of cooperation and coordination between various Trades and Subcontractors will be allowed.

18. PROTECTION

The Contractor shall assume the responsibility for initiation and maintenance of protective requirements specified under Protections in Section 01 50 00 TEMPORARY FACILITIES & CONTROLS.

19. REPAIR OF DAMAGE

The Contractor shall assume responsibility for any loss or damage caused by these operations or any Trade to the Work, or to materials, to adjacent property and existing structures and to persons, and make good any loss, damage or injury without cost to the Owner.

20. USE OF STREETS

A. The Contractor shall conform to government ordinances, rules and/or regulations applicable to the use of streets, roads and sidewalk areas.

B. The Contractor shall confine entrance and exit to the site by truck route designated on the Drawings, or assigned at pre-construction conference.

C. Temporary closing of service drives or parking lots not shown as closed on Drawings will only be allowed if acceptable by the Owner, the Property Owner and the School District. If closings are allowed, they will be scheduled in order to minimize inconvenience to the Owner.

D. The Contractor will coordinate the closings by notifying the Owner's representative in writing at least two weeks in advance of any requested closing.

21. SECURITY

Conform to requirements of public laws, ordinances and regulations and the requirements of insurance carriers concerning security of the site while work is in progress as well as when it has been suspended.

22. DOCUMENTS AT THE SITE

A. Maintain at the site a reference copy of each approved Shop Drawing and of each Drawings, Specification, Addenda, revision and other Modification, in good order and marked currently by note to record each change made during construction on record prints.

1). Drawings shall be clearly marked "RECORD PRINTS" and not used for construction purposes. Mechanical Record Drawings shall show actual CFM rating in each space.

2). Prior to Pre-final Inspection, the information shall be transferred to a new, clean set of construction documents, titled, dated, labeled "Record Prints", signed by Contractor and Subcontractor(s) and submit the print(s), (including Specifications and Details) to the Contractor. Also obtain, when directed, or as necessary to properly execute the work, copies of literature, standards and other data referred to but not included in the Specifications. Such literature for each item of work shall be provided to the Contractor in triplicate for distribution. This shall include all installation instructions from all manufacturers.

B. The Record Prints will be checked monthly by the Contractor to determine that they are current. This will be a requirement for issuance of a Certificate for Payment.

23. CONSTRUCTION LOADING

A. General: Concrete slabs on grade and suspended floors have not been designed for heavy loading.

B. Slabs on Grade: Do not subject slabs on grade to excessive loading by shoring, storage of materials or operation of construction equipment unless adequately protected by planking. Maintenance of slabs in good condition is the responsibility of the Contractor, who shall remove all damaged areas of such slabs and replace them with new work at no cost to the Owner.

24. SPECIAL REQUIREMENTS

A. **Construction Storage and Parking**: Review TEMPORARY FACILITIES Section and the Drawings for designated areas.

B. **Circulation**: Confine construction operations to designated areas avoiding any interruption of vehicular circulation to the existing facilities. Should this requirement become unavoidable, submit a request to the Owner in writing at least two weeks prior to the anticipated interruption, stating the predicted time and/or work hours.

C. **Noise Control**: The Contractor shall execute the Work in this Contract as quietly as practicable to avoid unnecessary disturbances, while working on existing campuses.

Any complaints duly registered by the Owner of unacceptable noise levels shall be cause for the use of special precautions and methods of operation by the Contractor to reduce noises to acceptable levels. The Owner shall be the sole judge of the tolerability of noise levels.

The Owner shall be the sole judge of the tolerability of noise levels.

D. **Dust Control**: Control all dust, to Owner's satisfaction, in working area and involved portions of site including access roads or drives.

E. **Fire Protection**: Contractor shall be responsible for development of fire prevention and protection program for all work at the sites. All occupants of structures affected by the work shall be provided safe fire escape routes at all times during the Contract. Provide fire extinguishers specified in Section 01 50 00 TEMPORARY FACILITIES AND CONTROLS..

F. **Laying Out The Building**: General Contractor will employ an experienced and competent Registered Public Surveyor to lay out the structure(s) and establish a permanent and accessible bench mark from which the grades may be established and checked from time to time during the progress of the work. Before the final building pad is accepted and before the structural slab is cast, the Civil Engineer shall verify the finish slab elevation.

G. **Measurements**: Contractor and/or subcontractor shall verify all measurements at the building and shall be responsible for the quantities of all materials. No exchange or compensation will be allowed on account of difference between actual dimensions and measurements indicated on the Drawings. Any difference that may be found shall be submitted to the Contractor for clarification by the Architect, for instructions before proceeding with the work.

H. **Work Attire:** All employees shall be required to wear OSHA-approved hard hats, safety glasses and work shoes at all times on site.

25. PUMPING, SHORING, ETC.

A. Pumping: When necessary to avoid delay or to protect work or the premises, provide suitable pumping equipment and keep excavations, pits, and other areas involved free of water that may leak, seep, or rain in. Do not allow water to flow into excavations. Do not allow water to flow off site in quantities or at rates that exceed the quantities or rates that existed prior to the start of construction.

B. Shoring: The Contractor shall provide and be responsible for all temporary shoring required for executing and protecting work. After all construction is secure and stable, and when authorized by the Structural Engineer or Civil Engineer, the Contractor shall remove all shoring.

26. TEMPORARY COVERINGS

When necessary to avoid delay or to protect work or equipment, provide suitable watertight coverings over windows, doors, skylights, hatchways, and such other openings admitting rain including the Owner's materials within the building area when working on a combined effort.

27. HAZARDOUS MATERIALS

If during the course of his work, the Contractor observes the existence of asbestos, or asbestos Bearing materials, the Contractor shall immediately terminate further operations and notify Owner of the condition. The Owner will, after consultation, determine a further course of action. Contractor shall furnish Manufacturer's Safety Data Sheets (MSDS) on all materials and products installed by the Contractor and subcontractors on this project to indicate no asbestos-containing materials have been installed. Furnish to Owner for inclusion in close out document materials.

28. SUBSTANTIAL COMPLETION

"Substantial Completion" constitutes a stage of project completion that will allow Owner beneficial occupancy for the purpose of safely installing furnishings; maintaining normal security over them; and use of the facility, or substantially completed portion of the facility, for its intended use, but shall not be considered in any way as final completion.

29. TAX EXEMPTION CERTIFICATE

The Owner is a tax-exempt institution and will, as the Owner, issue a Tax Exemption Certificate to each Contractor, should they enter into a contract with any Bidder.

30. COORDINATION

The Contractor and Subcontractors on the project shall coordinate their work with each other, advising on work schedules, equipment locations, etc. It shall be the responsibility of Contractor to assure this coordination and to schedule and supervise the work of all Subcontractors performing work under this Contract.

31. OBSERVATION OF THE WORK

The Architect, his representatives, as well as the Owner's representatives, shall at all times have access to the work wherever it is in preparation or progress, and the Contractor shall provide proper and safe facilities for such access and for observation.

32. BUILDING PERMITS, SERVICE TAPS, LICENSES, ETC.

The Contractor and/or subcontractors shall be responsible for building permits, curb-cuts, contractor's license, utility hook-ups and connections, including temporary and permanent taps, meter fees, impact fees, capital improvement fees, etc., and any other fees and/or permits required by any governing governmental authority having jurisdiction in the area of the project.

1) Owner will pay for all permanent meter fees and service impact fees.
2) Contractor shall be responsible for paying for, applying for, and securing all permits (except for the Building Permits, see 2.4 below), licenses, deposits, construction meters, connecting of temporary utilities, other plan review fees, inspections, and all other fees required.
3) Owner to pay all costs and fees associated with securing a TCEQ site development permit.
4) Owner will initiated the plan review process and will apply for the building permits. The Owner will pay for all cost associated with obtaining the building permit. The contractor is responsible for completing the building permit application and paying all other costs.

33. COOPERATION WITH BUILDING OFFICIALS

Cooperate with applicable utility and government officials and inspectors at all times. If such official or inspector deems special inspection necessary, provide assistance and facilities that will expedite inspection.

34. PARKING AND STORAGE

Owner will designate areas for Contractors/Subs the use on site for parking, material, and equipment storage. At completion of project, the contractor shall clean area, making any repairs as required, to make sure that the site is returned to its original condition. Contractor and Subs shall minimize disruptions to surrounding school areas.

35. SAFETY

Contractor shall keep building and site clean to facilitate work and safety. Comply with all laws governing safety, specifically the "Occupational Safety and Health Standards (OSHA). The contractor shall be responsible for initiating, maintaining, and supervising for conformance to all safety programs and precautions necessary for compliance with all local, state, and federal codes and requirements. Architect, Engineers, Owner, and any of their employees and agents are not responsible for, or in any way in charge of, the safety of the work or any contractor or their employees or property.

36. CONSTRUCTION PERSONNEL BACKGROUND CHECKS AND FINGERPRINTING FOR WORK ON OCCUPIED CAMPUSES

Contractor shall conform to requirements of Senate Bill 9 regarding criminal history reports and fingerprinting for all on-site personnel hired after January 1, 2008 who will have direct contact with students. Refer to item 40 for additional requirements.

37. SCHOOL OPERATIONS/CONSTRUCTION PERSONNEL

A. Schools will be in operation with all classes full during the majority of the construction.

1) Contractor, subcontractors, owner, and architect shall meet weekly to coordinate and schedule any construction activities affecting school operations including quiet days for testing, student/staff holidays, etc.

2) Student safety is of utmost importance. Fire and life safety exiting from buildings must be maintained at all times and closely monitored. Review and receive approval for changes in existing conditions with the local fire marshal for each phase of construction. Provide temporary signage as required by the fire marshal.

3) Fire arms, drugs, intoxicating beverages, X-rated materials, etc. shall be kept off all school grounds and property. Smoking on school grounds is prohibited.

4) The use of tobacco, alcohol, or illegal drugs is specifically prohibited on school property. The Contractor shall inform all construction personnel employed at the site and enforce these requirements.

5) Construction workers are not to communicate or interact in anyway with students and staff on site. Only the project superintendent and/or his appointed representatives may communicate with only administrative staff on an as needed basis.

B. Dress and Language Code

1) It is the intent to provide an acceptable appearance and manner of the forces to the personnel, visitors, and general public while the contractor's forces are on the project site.

2) A dress code shall be in effect for this project. Field forces involved in the construction shall have contractor identification, either on clothing or in the form of badges. It is the intent of the dress code to provide:

a. Identification of the contractor and subcontractors work forces. Each worker's hardhat is to have an individual minimum "2" numbers on each side of hat. A log of these assigned numbers is to be turned over to the owner and maintained at the general contractor's trailer.

b. An acceptable appearance of the forces to the personnel, visitors, and general public while the contractor's forces are on project site.

c. Construction workers are to be fully clothed at all times. Work clothing and protective gear shall comply with all local, state, and federal requirements. Clothing may not display any logos or slogans other than from the company for which the worker is employed.

3) A language code shall be in effect for this project. Contractor's forces shall not use offensive, vulgar, or other such unacceptable language or gestures while on the project site.

4) Violations of any items listed in A & B are reason to immediately remove the worker permanently from the jobsite.

38. FENCING, BARRICADES AND WARNINGS

Contractor shall provide, install, and service the necessary barricades for the protection of the public as shown in the Contract Documents and as required by local state and federal regulations, codes, and

ordinances. Contractor shall install and maintain chain link construction fencing with access gates as necessary around building site.

39. NOTIFICATION

The contractor shall notify the architect at least 48 hours in advance (Monday thru Friday) of concrete pours, roofing installation, start of each new section or classification of work, concealment of plumbing, heating, air conditioning, or electrical work.

40. FIELD MEASUREMENTS

The contractor will employ an experienced, competent civil engineer to establish or survey the building lines, elevations, and minimum of two construction phase benchmarks. Each contractor shall verify all existing grades, lines, levels, and dimensions at job site.

41. TESTING AND OPERATION OF MACHINERY

Owner shall test mechanical devices, machinery, apparatus, equipment, etc. shall be tested prior to final completion of project and acceptance.

Testing shall be by thoroughly knowledgeable and competent manufacturer's representative. Representative shall instruct owner to properly operate and maintain equipment. Such testing and operation shall neither constitute acceptance nor start of Guarantee or Warranty. The contractor is to provide a labeled VHS video tape recording of each owner instruction session.

Contractor shall deliver all written operating instructions and equipment manuals to owner and provide copies of transmittals to Architect with record drawings, etc. at end of the contract.

42. WATCHMAN

Each contractor or sub, at their own expense and option, may employ a watchman as deemed necessary to protect or attend their work.

43. OWNER'S OCCUPANCY

Each contractor agrees that the owner may award separate contracts for certain items of work and equipment and place and install as much equipment, furniture, etc., during the progress of the building as is possible before completion of the various parts of the work, and shall agree that such placing and installing of equipment, etc., shall not in any way evidence the completion of the work or any portion of it. Contractor shall coordinate his work with that of work by owner to insure that each portion of the work can proceed smoothly. Any item noted NIC (Not in Contract) shall be provided and installed by the owner.

44. MISCELLANEOUS

A. Where "similar" is noted in contract documents, the intent is similar not same as. "Similar" conditions require modification to fit the exact condition, coordination of other materials, equipment, etc., additional bracing, blocking, materials and labor as required for complete construction.

B. Where "typical" is noted in contract documents, the intent is that materials, labor, and total construction shall occur everywhere throughout project where the conditions occur.

C. Dissimilar metals shall be isolated from each other with tape, packing, isolation pads, or other methods as necessary.

D. Where "provide" is noted in the contract documents, the intent is that materials, labor, and total construction shall occur at that condition.

45. TOXIC AND HAZARDOUS MATERIALS

Toxic and hazardous materials, including but not limited to products or materials containing formaldehyde, asbestos, ACM's, PCB's, lead, etc. shall not be provided nor installed in any portion of any new construction work. Subcontractors and all contractors will be required to sign a statement to this effect. Subcontractors and General Contractor will be required to sign a statement to this effect. Contractor shall furnish Manufacturer's Safety Data Sheets (MSDS) on all materials and products installed by Contractor on these projects to indicate no asbestos-containing materials have been installed; include as part of Owner's close out documents.

46. LEAD RENOVATION, REPAIR AND PAINTING RULE (RRP RULE)

The EPA Lead Renovation, Repair and Painting Rule shall apply under this contract if facility being renovated under the scope of this project houses pre-school or kindergarten students and was **constructed before 1978**.

Any firm performing renovation, repair and painting that disturbs lead-based paint in the above type facility shall have their firm certified by EPA (or an EPA authorized state) as a Lead-Safe Certified Renovation Firm, use certified renovators trained by EPA approved training providers and follow lead-safe work practices.

Refer to the following websites for more information:

http://www2.epa.gov/lead/epa-lead-safe-certification-program

http://www2.epa.gov/lead/renovation-repair-and-painting-program

47. PROJECT SIGNS

Provide and install project sign at building site. Sign shall be 8' x 16' x ¾", exterior grade B-C (sanded both sides). Install sign on wolmanized wood posts. Posts shall extend 3' into ground and sign shall begin 2' off ground. School District slogan, project name, owner, architect, engineers, contractor, and prime subcontractors should be painted on face of sign. Architect will provide exact wording, letter size, spacing, colors, etc. Sign shall be erected within one (1) month after start of construction. No other signs shall be displayed unless approved by owner. Also, provide additional 4 x 8 directional and or safety signs as required. Construct and install signs as directed by owner.

48. WORKER'S COMPENSATION

Full compliance with the requirements of the Texas Labor Code 4406.096 to provide worker's compensation insurance is mandatory. The Contractor will be required to provide certificates of coverage for the contractor's employees and retain certificates of coverage on file in accordance with Rule 110.110 adopted by the Texas Workers' Compensation Commission. A copy of the provisions of subsection (c) paragraph (7) of this rule is included herein. Additional requirements for insurance are indicated in Document 00722 General Conditions A201 and Document 00730 Supplementary General Conditions.

49. BONDS AND INSURANCE – REFER TO SECTION 00 73 16 – INSURANCE AND BOND REQUIREMENTS FOR CONTRACTORS

After award of contract by owner, contractor shall immediately (within 7 days) secure acceptable bonds and insurance so that contractor may begin work after Notice to Proceed is issued by the Owner.

50. FAILURE TO COMPLETE WORK ON SCHEDULE (LIQUIDATED DAMAGES)

A. Owner and contractor recognize that time is of the essence in this agreement and that owner will suffer financial loss if each substantial completion date, plus any authorized adjustments, are not met. They recognize the delays, expense, and difficulties involved in proving in a legal proceeding the actual losses or damages (including special, indirect, consequential, incidental, and any other losses or damages) suffered by the owner if each substantial completion date is not met. Accordingly and instead of proof of such losses or damages, owner and contractor agree that as liquidated damages for delay, but not as penalty, contractor shall pay the owner the sum **of $300.00 for each day** that expires after the expiration of the time period set forth for each phase subject to liquidated damages.

B. Extensions of Time: The contractor shall not be charged with liquidated damage for delay if:

1. The delay in the completion of the work arises form unforeseeable causes beyond the control and without the fault or negligence of the contractor including, but not restricted to, acts of God, acts of the public enemy acts of federal, state, or local government in its sovereign capacity, fires, floods, epidemics, quarantines, strikes, freight embargos, and adverse weather conditions not reasonably anticipated (see Supplementary General Conditions 4.3.7.2.1). And

2. The contractor within two (2) days from the beginning of any such delay shall notify the architect and owner, in writing, of the causes of delay. Contractor shall provide such documentation, signed affidavit, etc. as required by owner to substantiate claim for delay. Owner's notification shall be acknowledged by initialing and dating by owner's designated representative.

C. See Summary of Work Section 01 11 00 for additional contract requirements relating to project schedules and extensions of time.

D. Disputes:

1). No claim by the contractor for additional time shall be allowed unless it be timely presented in writing.

2). If the Board of Trustees of the district should reject the contractor's claim or if the Board of Trustees should fail to allow the contractor's claim within ninety (90) days after it is filed with the Board, the contractor's administrative remedy under this contract shall be deemed to be exhausted.

3). No suit shall be brought by the contractor upon this contract or for breach of this contract until his administrative remedy shall have been exhausted nor more than two (2) years after it shall have been exhausted.

4). During the pendency of any claim, the contractor shall proceed diligently with the work.

51. DEMOLITION – REFER TO SECTIONS 02 41 00 – DEMOLITION

A. Contractor is to meet the following National Pollution Discharge Elimination System (NPDES) requirements:

Effective March 5, 2003, the Environmental Protection Agency (EPA) authorized the Texas Commission on Environmental Quality (TCEQ) to administer Phase I and II of the National

Pollution Discharge Elimination System (NPDES). These changes are effective immediately and affect all projects disturbing more than 1 acre of land, including projects currently under construction.

- The NPDES general permit is being replaced by the Texas State TPDES general permit, and
- The TPDES general permit is required for projects disturbing 1 acre or greater or soil.

Since July 1998, Phase I of this program previously required an EPA Notice of Intent (NOI) form to be sent directly to the EPA prior to the start of construction for projects disturbing more than 5 acres. Sites disturbing less than 5 acres were previously exempt from the Phase I requirements.

For sites greater than 5 acres, Phase II now requires a modified NOI form, for use in Texas, be completed and sent to the TCEQ and the local municipality 48 hours prior to the start of construction. A copy of the form must be posted on the construction site.

For all sites disturbing between 1 and 5 acres, Phase II of the program now also requires that a "Construction Site Notice" form be completed. This form must be sent to the local municipality 48 hours prior to the start of construction and a copy posted on the construction site.

Phase II of the program also requires all sites disturbing 1 acre or greater to develop, implement and keep on site, a Storm Water Pollution Prevention Plan (SWPPP). These projects are also required to obtain a copy of the TCEQ TPDES General Permit No. TXR150000. Failure to comply with these requirements can result in administrative fines as established by the TCEQ.

A summary of the notification requirements based upon project area and construction start date is provided below:

Disturbed Area*	**Construction Started Before March 5, 2003**	**Construction Started After March 5, 2003**
>5 acres	- Continue to meet requirements of existing NPDES general permit - Submit a TPDES NOI form if Construction is not completed prior to June 3, 2003 - Notify TCEQ if Construction is completed prior to June 3, 2003	- Submit a TPDES NOI Form to TCEQ 48 hours prior to the start of Construction
1<5 acres	- Post the Construction Site notice - Submit the Construction Site Notice to municipality	- Post the "Construction Site Notice" 48 hours prior to Construction - Submit the "Construction Site Notice" to Municipality 48 hours prior to the start of Construction
<1 acre	- TPDES permit not required	- TPDES permit not required

Area of disturbance includes smaller projects when they are part of a larger common development.

TEXAS Department of State Health Services

For Office Use Only:

Notification #:_____

ASBESTOS/DEMOLITION NOTIFICATION FORM

DO NOT WRITE IN THIS BOX- FOR DEPARTMENT USE ONLY
Date received:___/___/___ Postmark date:___/___/___ Walk-in date:___/___/___

TYPE OF NOTIFICATION: ***(Select one and fill in the requested information)***

☐ **ORIGINAL** ☐ **AMENDMENT No. ___** ☐ **CANCELLATION**

☐ **EMERGENCY**

- Was emergency request made to the Regional Office or Environmental Health Notifications Group (EHNG) by phone?

☐Yes ☐No

- If yes, the DSHS reference #:_____ and name of the Regional or EHNG representative with whom you spoke?

_____

Date: __/__/__ Time: _____ ☐a.m. ☐p.m.

- Describe the reason for Emergency: _____

_____

☐ **ORDERED: (*For structurally unsound facilities, attach copy of demolition order and identify Governmental Official)***

Name: _____ Registration No. _____

Title: _____

Date of order (MM/DD/YY): __/__/__ Date order to begin (MM/DD/YY): __/__/__

(x) Below if Amended

AMENDMENTS: ***You must complete the entire form and mark the appropriate check box(es) along the left-hand side of this form to indicate amended information.***

TYPE OF WORK

☐ Asbestos Abatement ☐ Demolition ☐ Annual Consolidated O&M ☐ Abatement/Demolition

Is this a phased project? ☐ Yes ☐ No

FACILITY INFORMATION

1. Facility Location

☐……. Description or Facility Name: _____

☐……. Physical Address: _____

☐……. County: _____ City: _____ Zip: _____

☐……. Facility Contact: _____ Phone #: (___) ___-____

2. Type of Facility ***(Select one)***

☐ Public ☐ Federal ☐ Industrial/Manufacturing ☐ NESHAP-Only ☐ Public School K-12

3. Facility Details

☐…… Description of Area/Room Number: _____

☐…… Age of Building: ____ Size: _____ Number of Floors: ___
☐…… Is this building occupied? ☐ Yes ☐ No
☐…… Prior Use: _____
☐…… Future Use: _____
☐…… Date of Asbestos Survey/NESHAP Inspection: __/__/__
☐…… DSHS Inspector License #: _____
☐…… Analytical Method: ☐ PLM ☐ TEM ☐ Assumed Asbestos ☐ No Suspect Material
☐…… DSHS Laboratory License #: _____

WORK SCHEDULE/ASBESTOS AMOUNTS (***Note: if the start date(s) entered below cannot be met, the DSHS Regional or Local Program office must be notified prior to the scheduled start date. Failure to do so is a violation of TAHPA Section 295.61.)***

1. Asbestos Abatement Work Schedule:
☐…… Start date: __/__/__ and End date: __/__/__
☐…… Work days: ☐Mon. ☐Tues. ☐Wed. ☐Thurs. ☐Fri. ☐Sat. ☐Sun.
☐…… Working hours: _____ ☐ a.m. ☐ p.m. to _____ ☐a.m. ☐p.m.

2. Demolition Work Schedule:
☐…… Start date: __/__/__ and End date: __/__/__
☐…… Work days: ☐Mon. ☐Tues. ☐Wed. ☐Thurs. ☐Fri. ☐Sat. ☐Sun.
☐…… Working hours: _____ ☐ a.m. ☐ p.m. to _____ ☐a.m. ☐p.m.

(x) Below if Amended

C. ASBESTOS AMOUNTS
☐…… Is Asbestos Present? ☐ Yes ☐ No ***(Complete the table below if asbestos is present)***

Asbestos-Containing Building Material Type	**Approximate amount of Asbestos**						
Only mark the boxes below on this chart if they are being amended	**Pipes**	**Ln Ft**	**Ln M**	**Surface Area**	**SQ Ft**	**SQ M**	**Cu Ft**
☐**RACM to be removed**		☐	☐		☐	☐	
☐**RACM left in place during demolition**		☐	☐		☐	☐	
☐**Interior Category I non-friable removed**		☐	☐		☐	☐	
☐**Exterior Category I non-friable removed**		☐	☐		☐	☐	
☐**Category I non-friable left in place during demolition**		☐	☐		☐	☐	
☐**Interior Category II non-friable removed**		☐	☐		☐	☐	
☐**Exterior Category II non-friable removed**		☐	☐		☐	☐	
☐**Category II non-friable left in place during demolition**		☐	☐		☐	☐	
☐**RACM Off-Facility Component**							

DESCRIPTION OF WORK PRACTICES AND PROCEDURES

☐…… **1**. Description of procedures to be followed in the event that unexpected asbestos is found or previously non-friable asbestos
material becomes crumbled, pulverized, or reduced to powder: _____
_____
_____

☐…… **2.** Description of planned demolition or abatement work, type of material, and method(s) to be used: _____
_____
_____

☐……. **3.** Description of work practices and engineering controls to be used to prevent emissions of asbestos at the demolition site:

_____
_____
_____

PROJECT INFORMATION

☐…… **A. FACILITY OWNER**
Facility Owner Name: _____
Phone #: (___) ___-____
Attention: _____
Mailing Address: _____
City: _____ State: _____ Zip: _____

☐…… **B. ASBESTOS ABATEMENT CONTRACTOR #1**
DSHS Asbestos Contractor License #: _____
Contractor Name: _____

Address: _____
City: _____ State: _____ Zip: _____
Office Phone #: (___) ___-____ Job-Site Phone #: (___) ___-____

☐…… **C. ASBESTOS ABATEMENT CONTRACTOR #2 (O*nly if there is more than one Contractor)***
DSHS Asbestos Contractor License #: _____
Contractor Name: _____
Address: _____
City: _____ State: _____ Zip: _____
Office Phone #: (___) ___-____ Job-Site Phone #: (___) ___-____

D. ASBESTOS SUPERVISOR
☐…… DSHS Supervisor License #: _____ Site Supervisor: _____
☐…… DSHS Supervisor License #: _____ Site Supervisor: _____

(x) Below if Amended **E. NESHAP TRAINED INDIVIDUAL**
☐…… NESHAP Trained Individual: _____
Certification Date: __/__/__

☐……**F. DEMOLITION CONTRACTOR**
Demolition Contractor: _____
Address: _____
City: _____ State: _____ Zip: _____ Phone #: (___) ___-____

☐……**G. PROJECT CONSULTANT OR OPERATOR**
DSHS License No.: _____
Project Consultant or Operator: _____
Address: _____
City: _____ State: _____ Zip: _____ Phone #: (___) ___-____

☐…… **H. Waste Transporter**
DSHS Waste Transporter License #: _____

Waste Transporter: _____
Address: _____
City: _____ State: _____ Zip: _____
Contact Person: _____Phone #: (___) ___-____

☐ ……**I. Waste Disposal Site**
TCEQ Permit #: _____
Waste Disposal Site: _____
Address: _____
City: _____ State: _____ Zip: _____
Phone #: (___) ___-____

CERTIFICATION STATEMENT

I hereby declare that I have examined this notification and, to the best of my knowledge and belief, all information provided is complete, true, and correct. I affirm that I am the owner, operator, or delegated agent and that I am responsible for the fee associated with this notification. I also understand that the owner, operator, or delegated agent is responsible for notification to the department.

_____ Date: __/__/__
(Signature of Owner, Operator or Delegated Agent)

_____
(Printed Name & Title)

E-mail Address: _____ Phone #: (___) ___-____

IMPORTANT INFORMATION

NOTIFICATION TIMELINESS REQUIREMENT:
Your Asbestos/Demolition Notification form must be postmarked no less than ten working days (not calendar days) prior to the start of any asbestos abatement or demolition.

FILING FEE: An invoice will be mailed to the facility owner upon completion of the project.

CALL FOR ASSISTANCE: (512) 834-6747 or (888) 778-9440 (toll free in Texas)

MAIL FORM TO: ENVIRONMENTAL HEALTH NOTIFICATIONS GROUP
TEXAS DEPARTMENT OF STATE HEALTH SERVICES
PO BOX 143538
AUSTIN, TX 78714-3538

CONTRACTOR'S AFFIDAVIT OF NON-USE OF ASBESTOS

(Insert name of Project):_____

(Insert name of Owner): _____

The undersigned Contractor hereby certifies and affirms that the building materials used for construction by the Contractor or any person or firm representing or represented by the Contractor, do not contain any asbestos materials or any other prohibited materials as defined by laws, rules and regulations promulgated by the Federal Government, The State of Texas, and any governmental organization operating under these entities, except when specifically authorized in writing by the Owner. A copy(s) of that (those) authorization(s), if any is (are) attached.

The undersigned Contractor hereby certifies and affirms that the Contractor shall be totally responsible for any and all costs incurred in removing any asbestos or prohibited materials determined to be part of the building materials as a result of inspection and sample analysis performed by individuals or firms certified to perform asbestos prohibited materials inspection and sample analysis under the laws, rules and regulations of the Federal Government and the State of Texas.

The undersigned Contractor hereby certifies and affirms that the Contractor shall pay for any and all damages resulting from the inability of the Owner to comply with all laws, rules and regulations governing the Asbestos Hazard Emergency Response Act of 1987, and all other laws, rules and regulations governing public buildings.

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument this _____ day of _____, 20__.

_____
Authorized Signature - Print Name & Title

Company Name: _____

Personally appeared before the undersigned, _____, who, after being sworn, deposes and says that the facts stated in the above certification are true.

_____ for the State of Texas
Notary Public

_____ My Commission Expires
Printed Name of Notary Public

Notary Seal:

CONTRACTOR'S AFFIDAVIT OF NON-USE OF LEAD

The undersigned affirms and certifies that "to the best of their knowledge and belief lead and PCB containing materials have not been used or incorporated into the Work and lead or lead bearing materials have not been incorporated into potable water systems", including, but not limited to those water systems for drinking fountains, all sinks, showers, bath tubs, residential and commercial kitchen equipment, ice machines, and hose bibbs, as applicable to the project, and that lead sheet flashing used in through roof plumbing penetration applications is the only lead on the project.

DATE: _____

PROJECT NAME: _____

OWNER: _____

JOB DESCRIPTION: _____

_____

_____

_____

CONTRACTOR: _____

_____

CONTRACTOR'S SIGNATURE _____ DATE _____

Failure to complete this certificate constitutes non-compliance with the job specifications and an unacceptable job.

Signed before me this _____ day of _____, 20_____.

_____ for the State of Texas
Notary Public

_____ My Commission Expires
Printed Name of Notary Public

Notary Seal:

SUBCONTRACTOR'S / MATERIAL SUPPLIER'S AFFIDAVIT

STATE OF TEXAS
COUNTY OF _____

BEFORE ME, the undersigned authority, on this day personally appeared _____ personally known to me to be the person whose name is subscribed hereto, and who, upon his oath deposes and says as follows:_____

_____

That he, as subcontractor and/or material supplier, furnished certain labor and materials which form a part of certain improvements constructed on the following property, to wit:

(Insert project name):_____

(Insert name of owner):_____
and that he personally knows that all bills for materials furnished and labor performed in connection with his subcontract/purchase order on the improvements constructed on the above described property have been fully paid.

He further covenants and guarantees that there are no other person or firms whatsoever (materials, supplies, laborers or others in any way involved in the furnishing of goods and/or work or labor on his subcontractor and / or materials purchase order heretofore had, now have, or may hereafter be entitled to any liens or claims against the above set out property.

He does further agree to hold the Contractor and/or Owner wholly harmless and/or fully indemnify them against any and all liens, claims or demands of any or every kink and nature which may in any way arise out of the furnishing of any of the materials, labor or other services or products in connection with my subcontract and/or supplier of materials.

_____
Name of Subcontractor/Material Supplier

By _____

BEFORE ME, a Notary Public, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument, after being duly sworn, deposed and said that the facts stated above are true. Given under my hand and seal office this

_____ day of _____, 20____.

_____ for the State of Texas
Notary Public

_____ My Commission Expires
Printed Name of Notary Publ

Notary Seal:

AFFIDAVIT OF NON-USE OF UREA-FORMALDEHYDE

(Insert project name):_____

(Insert name of Owner):_____

The undersigned Contractor hereby certifies and affirms that the building materials used for construction by the Contractor or any person or firm representing or represented by the Contractor, do not contain any urea-formaldehyde materials or any other prohibited materials as defined by laws, rules and regulations promulgated by the Federal Government, The State of Texas, and any governmental organization operating under these entities, except when specifically authorized in writing by the Owner. A copy(s) of that (those) authorization(s), if any is (are) attached.

The undersigned Contractor hereby certifies and affirms that the Contractor shall be totally responsible for any and all costs incurred in removing any urea-formaldehyde or prohibited materials determined to be part of the building materials as a result of inspection and sample analysis performed by individuals or firms certified to perform asbestos prohibited materials inspection and sample analysis under the laws, rules and regulations of the Federal Government and the State of Texas.

The undersigned Contractor hereby certifies and affirms that the Contractor shall pay for any and all damages resulting from the inability of the Owner to comply with all laws, rules and regulations governing public buildings

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument this _____ day of _____, 20____.

_____
Authorized Signature - Print Name & Title

Company Name:_____

Personally appeared before the undersigned, _____, who, after being sworn, deposes and says that the facts stated in the above certification are true.

_____ for the State of Texas
Notary Public

_____ My Commission Expires
Printed Name of Notary Public

Notary Seal:

AFFIDAVIT OF
LIMITED USE OF UREA-FORMALDEHYDE FOR HARDWOOD PLYWOOD, PARTICLEBOARD OR MEDIUM DENSITY FIBERBOARD

(Insert project name):_____

(Insert name of Owner):_____

The undersigned Contractor hereby certifies and affirms that the hardwood plywood, particleboard or medium density fiberboard building materials used for construction by the Contractor or any person or firm representing or represented by the Contractor, are in conformance with the **EPA - FORMALDEHYDE STANDARDS ACT, 40 CFR Part 770, Federal Register Vol. 81, No. 238; effective 02/10/2017**

https://www.regulations.gov/document?D=EPA-HQ-OPPT-2016-0461-0001

The undersigned Contractor hereby certifies and affirms that the Contractor shall be totally responsible for any and all costs incurred in removing any non-conforming urea-formaldehyde hardwood plywood, particleboard or medium density fiberboard products, or prohibited materials determined to be part of the building materials as a result of inspection and sample analysis performed by individuals or firms certified to perform prohibited materials inspection and sample analysis under the laws, rules and regulations of the Federal Government and the State of Texas.

The undersigned Contractor hereby certifies and affirms that the Contractor shall pay for any and all damages resulting from the inability of the Owner to comply with all laws, rules and regulations governing public buildings.

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument this _____ day of _____, 20____.

_____
Authorized Signature - Print Name & Title

Company Name: _____

Personally appeared before the undersigned, _____, who, after being sworn, deposes and says that the facts stated in the above certification are true.

_____ for the State of Texas
Notary Public

_____ My Commission Expires
Printed Name of Notary Public

Notary Seal:

CONTRACTOR'S AFFIDAVIT

STATE OF TEXAS
COUNTY OF _____

FROM:_____
(Name of Contractor)

_____
(Name of Owner)

RE: The Contract entered into the _____ day of _____, 20____, between the above mentioned parties for the construction of (insert project name:)_____

_____

(Insert name of owner):_____

1. The undersigned hereby certifies that all work required under the above contract has been performed in accordance with the terms thereof, that all material, men, subcontractors, mechanical and laborers have been paid and satisfied in full, and that there are no outstanding claims of any character arising out of the performance of the Contract which have not been paid and satisfied in full.

2. The undersigned further certifies that (to the best of his knowledge and belief), there are no unsatisfied claims for damages resulting from injury or death to any employees, subcontractors, or the public at large arising out of the performance of the Contract, any suite or claims for any other damage of any kind, nature, or description which might constitute a lien upon the property of the Owner.

3. The undersigned makes this affidavit as specified for the purpose of receiving final payment in full settlement of all claims arising under or by virtue of the Contract, and acceptance of such payment is acknowledge as a release from the Owner from any and all claims arising under or by virtue of the Contract.

IN WITNESS WHEREOF, the undersigned has signed and sealed this instrument this _____ day of _____, 20____.

_____
Name of Contractor

By_____
Authorized Signature

Title:_____

BEFORE ME, a Notary Public, on this day personally appeared _____, known to me to be the person whose name is subscribed to the foregoing instrument, after being duly sworn, deposed and said that the facts stated are true. Given under my hand and seal of office this

_____ day of _____, 20____.

_____ for the State of Texas
Notary Public

_____ My Commission Expires
Printed Name of Notary Public

Notary Seal:

SUBCONTRACTOR WARRANTY

STATE OF TEXAS

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the Subcontractor (or the _____of_____ the subcontractor) who supplied, installed, and/or erected the work described below, and that, he / she is duly authorized to make this Subcontractor Warranty:

   Project: _____
   Owner: _____
   Architect: Pfluger Associates Architects
   Work Performed: _____Specification Section(s): _____

2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Subcontractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.

4. The Subcontractor warrants the work performed for a period of _____ months from the date of Substantial Completion, except as follows: _____

ATTEST (If Corporation)

_____
Name of Subcontractor

_____
Secretary (By) (Title)

_____

STATE OF TEXAS

COUNTY OF _____

Sworn to and subscribed before me on this _____ day of _____, 20_____

(Seal)

_____
Notary Public Signature

FELONY CONVICTION NOTIFICATION

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History, Subsection (a), states "a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or an owner or operator of the business entity has been convicted of felony. The notice must include a general description of the conduct resulting in the conviction of a felony."

Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract."

This Notice is not required of a Publicly-Held Corporation.

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony convictions has been reviewed by me and the following information furnished is true to the best of my knowledge.

_____
Vendor's Name

_____
Authorized Company Official's Name (Printed)

A. My firm is a publicly-held corporation; therefore, this reporting requirement is not applicable.

_____
Signature of Company Official

B. My firm is not owned nor operated by anyone who has been convicted of a felony.

_____
Signature of Company Official

C. My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:
Name of Felon(s):

_____

_____

Details of Conviction(s):

_____

_____

_____
Signature of Company Official

DATA REQUIRED BY SENATE BILL 9
For
NATIONAL CRIMINAL HISTORY CHECK

The school district under this contract is required by Texas Education Code, Chapter 22, Subchapter C to review the criminal history of applicants, employees, independent contractors, student teachers, and certain volunteers. The information requested below is necessary to obtain criminal history record information.

Last Name _____

First Name _____

Middle Name _____

Driver's License Number _____

Driver's License State _____

Date of Birth _____ _____ _____
Month (00) Day (00) Year (YYYY)

Mailing Address _____

City _____

State _____

Zip Code _____

Sex: ☐ Male ☐ Female Ethnicity: ☐ Black ☐ White/Other

Email Address: _____

Phone Number: _____

I understand the information I am providing about age, sex, and ethnicity will not be used to determine eligibility for employment but will be used solely for the purpose of obtaining criminal history record information.

I understand that it is my responsibility to update this information with the school district immediately if any changes occur.

_____ _____
Applicants Signature Date

CRIMINAL HISTORY CHECK FOR CONTRACTORS

In accordance with the Texas Education Code Section 22.0834 adopted in Senate Bill 9 (SB 9) by the 80th session of the Texas Legislature, Texas school districts are required to obtain a criminal history record of contractor employees who have direct contact with students.

Your signature below acknowledges that you have read and understand that the school district will conduct inquiries into police records, and/or any other criminal records as required by law.

Full Name (Print): ____

Signature: ____

Date of Birth: ______________ ______________ ______________
Month Day Year

Driver's License#: ____
Number State

State ID#: ____
Number State

Social Security #: ____

Ethnicity (Check One): ☐ White ☐ Black ☐ Hispanic ☐ Other

Sex (Check One): ☐ Male ☐ Female

The abovce data, i.e. race, sex, date of birth will not be used for employment purposes, but is required for identification purposes for the criminal records check.

- -

(This Section to be completed by Employer)

EMPLOYER VERIFICATION

I, ______________________________, with

____
(printed name of supervisor) (printed name of company)
do hereby affirm that the information provided on this form matches the payroll information on file for this employee.

______________________________ ______________________
Signature of Supervisor Date

COPY DRIVER'S LICENSE OR STATE ID

CERTIFICATION OF PROJECT COMPLIANCE

Distribution to:

- District ☐
- Contractor ☐
- Other ☐
- Architect/Engineer ☐
- Texas Education Agency ☐
- Building Department ☐

1.PROJECT INFORMATION

DISTRICT:

Facility:

ARCHITECT/ENGINEER:

Address:

CONTRACTOR/CM:

City:

CONTRACT DATE:

DATE DISTRICT AUTHORIZED PROJECT:

BRIEF DESCRIPTION OF PROJECT:

---

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT: **BY:** **DATE:**

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: **BY:** **DATE:**

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM: **BY:** **DATE:**

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: **BY:** **DATE:**

INSTRUCTIONS FOR COMPLETION OF "CERTIFICATION OF PROJECT COMPLIANCE" FORM

Section 1. Identify the following:
- – name and address of the school facility
- – the Architect/Engineer and Contractor
- – the school district's project number (if applicable)
- – the date of execution of the construction contract
- – name, address, and telephone number of the school district
- – the date that the school district authorized the superintendent to hire an architect/engineer
- – scope of the project.

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.104, School Facilities Standards) and returned to the school district's files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district's files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

END OF SECTION 01 10 00

SECTION 01 21 00 ALLOWANCES

PART 1 - GENERAL

ALL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements governing allowances.

1. Selected materials and equipment are specified in the Contract Documents by allowances. In some cases, these allowances include installation. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued.

1.03 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise the Architect of the date when the final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At the Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by the Architect from the designated supplier.

1.04 SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

B. Submit invoices or delivery slips to show the actual quantities of materials delivered to the site for use in fulfillment of each allowance.

1.05 BETTERMENT AND CONTINGENCY ALLOWANCES

A. Use the betterment and contingency allowance only as directed by Architect and Owner for the Owner's purposes and only by Contingency Allowance Expenditure Authorization that indicate amounts to be charged to the allowance.

B. Contingency Allowance Expenditure Authorizations authorizing use of funds from the betterment and contingency allowance will include Contractor's related material and labor costs. Overhead and profit for betterment and contingency allowances is included in contract sum and therefore contractor overhead and profit shall not be added to cost amounts charged to this allowance.

C. At Project closeout, credit 100% unused amounts remaining in the betterment and contingency allowance to the Owner by Change Order.

1.06 STIPULATED SUM ALLOWANCES

A. Use the stipulated sum allowance for the purchase of materials, labor, installation, overhead and profit to be included in the contract sum. Any difference in cost and allowance will be returned to the Owner.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine products covered by an allowance promptly upon delivery for damage or defects.

3.02 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.03 SCHEDULE OF ALLOWANCES:

A.	Allowance #1: Owner's Contingency Allowance	$400,000.00
B.	Allowance #2: Network Equipment & Phone Allowance (assuming e-rate is not available)	$750,000.00
C.	Allowance #3: Cameras Only Allowance Provide camera equipment, installation, and integration. Cabling is included in the project.	$200,000.00
D.	Allowance #4: Access Control Allowance Provide equipment, installation, and integration, for head-in equipment in IDF's. Hardware is included in Division 8 of the project.	$100,000.00
E.	Allowance #5: Utility Infrastructure Allowance	$30,000.00
F.	Allowance #6: Building Controls Allowance	$550,000.00
G.	Allowance #7: Supergraphics Allowance	$80,000.00
H.	Allowance #8: Static Pressure Pumps Allowance	$300,000.00

END OF SECTION 01 21 00

SECTION 01 22 00 UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for Unit Prices.

B. Related Requirements:
1. Section 01 26 00, Contract Modification Procedures: Includes procedures governing the preparation and handling of Project Change Orders.

1.3 DEFINITIONS

A. Unit Prices are an amount incorporated in the Contract Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 MEASUREMENT OF QUANTITIES

A. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel, or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.

B. Measurement by Volume: Measured by cubic dimension using mean length, width and height, or thickness.

C. Measurement by Area: Measured by square dimension using mean length and width or radius.

D. Linear Measurement: Measured by linear dimension, at the item’s centerline or mean chord.

E. Stipulated Sum/Price Measurement: Items measured by weight, volume, area, or linear means, or combination, as appropriate, as a completed item or unit of the Work.

1.5 PROCEDURES

A. Unit Prices include necessary material, plus all required labor, tools, equipment, plant, transportation, delivery, services, incidentals, erection, application, or installation of an item of the Work, insurance, overhead, and profit.

B. Measurement and Payment: See individual Specification Sections for Work that requires establishment of Unit Prices. Methods of measurement and payment for Unit Prices are specified in those Sections. Measurement methods delineated in the individual Specification Sections complement the criteria of this Section. Contractor shall take all measurements and compute quantities. The Architect, at the Architect’s sole discretion, will verify measurements and quantities reported by the Contractor.
1. Quantities indicated in the Contract Documents are for bidding and Contract purposes only. Quantities and measurements supplied or placed in the Work and verified by the Architect determine payment.
2. If the actual Work required more or fewer quantities than those quantities indicated, provide the required quantities at the Unit Price approved in the Contract Agreement.

C. Final payment for Work governed by Unit Prices will be made on the basis of the actual measurements and quantities accepted by the Architect multiplied by the Unit/Sum Price for Work which is incorporated in or made necessary by the Work.

D. Defect Assessment: Owner reserves the right to reject Contractor's measurement of Work-in-place that involves use of established Unit Prices and to have this Work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
1. The Contractor shall replace the Work, or portions of the Work, not conforming to specified requirements.
2. If, in the opinion of the Architect, it is not practical to remove and replace the Work, the Architect will direct one of the following remedies:
   a. The defective Work may remain, but the Unit Price will be adjusted to a new Price or reduced 50 percent at the discretion of the Architect.
   b. The defective Work will be partially repaired at the instruction of the Architect, and the Unit Price will be adjusted to a new Sum/Price or reduced 50 percent at the discretion of the Architect.

E. Non-Payment for Rejected Products: Payment will not be made for any of the following:
1. Products wasted or disposed of in a manner that is not acceptable to the Architect.
2. Products determined as unacceptable before or after placement.
3. Products not completely unloaded from the transporting vehicle.
4. Products placed beyond the lines and levels of the required Work.
5. Products remaining on-hand after completion of Work.
6. Loading, hauling, and disposing of rejected Products.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 UNIT PRICES:

A. Unit Prices for the following items will apply in the event additions to or deductions from the Work are required and authorized by a WRITTEN ORDER from the Architect to the Contractor. Unit Price information is provided by the Contractor in the Bid Proposal Form.

3.2 SCHEDULE OF UNIT PRICES

A. Add or delete CAT6 cabling up to 300 lineal feet.
1. Per LF _____ Dollars $ _____
(Amount written in words governs amount written in figures)

B. Unit Price 2: Data Outlet

Dollars $ _____
(Amount written in words governs amount written in figures)

C. Unit Price 1: Electrical Outlet

Dollars $ _____
(Amount written in words governs amount written in figures)

D. Unit Price 3: Cubic Yard of Concrete

Dollars $

(Amount written in words governs amount written in figures)

E. Unit Price 5: Square Foot of Sidewalk (based on profile)

Dollars $

(Amount written in words governs amount written in figures)

F. Unit Price 6: Chain Link Fencing

Dollars $

(Amount written in words governs amount written in figures)

G. Unit Price 7: Ornamental Fencing

_____

(Amount written in words governs amount written in figures)

END OF SECTION 01 22 00

SECTION 01 23 00 ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes administrative and procedural requirements governing Alternates.

1 .2 DEFINITIONS

A. Definition: An alternate is an amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if the Owner decides to accept a corresponding change in either the amount of construction to be completed, or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

B. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate the Alternate into the Work. No other adjustments are made to the Contract Sum.

1.3 PROCEDURES

A. Coordination: Modify or adjust affected adjacent Work as necessary to completely and fully integrate that Work into the Project.

B. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not mentioned as part of the Alternate. Include as part of each alternate, costs coordination, modification, and/or adjustment to accommodate the accepted alternate.

C. Notification: Immediately prior to the beginning of each phase of construction, the Owner shall notify the Contractor and Architect of the status of whether alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Execute accepted alternates under the same conditions as other Work of this Contract.

3.2 SCHEDULE OF ALTERNATES

A. ALTERNATE #1: The date for Substantial Completion is to be extended to June 8th. This alternate bid is due at the same time as the base bid (2 pm).

END OF SECTION 01 23 00

SECTION 01 25 13 PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.01 WORK INCLUDES

A. This Section specifies administrative and procedural requirements for handling requests for substitutions made both prior to receipt of bids and after as herein specified and procedural requirements governing the Contractor's selection of products and product options.

B. The Contractor's Construction Schedule and the Schedule of Submittals are included under Section "Submittals."

C. Refer to Section "Reference Standards and Definitions" for applicability of industry standards to products specified.

1.02 DEFINITIONS

A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.

B. Products: Shall mean items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor's previously purchased stock. The term "product" as used herein includes the terms "material", "equipment", "system", and other terms of similar intent.

1. Named Products: Are those identified by the use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the Contract Documents.

C. Materials: Shall mean products that must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form units of work.

D. Equipment: Is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

E. For purposes of this Project, the term “OR EQUAL” is defined as follows:

1. Any material or equipment that is the same or similar quality and will fully perform the duties specified will be considered ‘equal,’ by the Architect provided the bid submits proof that such material or equipment is of equivalent substance and function and is approved, in writing. The Architect/Engineer is the sole arbitrator for acceptance of an “equal” product.

2. Requests for the approval of ‘or equal’ shall be made in writing at least five business days prior to bid opening. During the bidding period, all approvals shall be issued by the Architect/Engineer in the form of addenda at least two business days prior to the bid opening date.”

3. For products specified by name and accompanied by the term ‘equal to’, ‘or equal,’ or ‘or equivalent,’ or ‘or approved equal,’ or ‘or approved,’ comply with requirements in Section 01 33 00 - Submittal Procedures’ for submitting a substitution request to obtain

approval for use of an unnamed product. These substitution requests must be submitted at least 5 days prior to the bid date."

1.03 APPROVED MANUFACTURERS (GENERAL REQUIREMENTS)

A. Acceptable product manufacturers are listed in each product section. This list of approved manufacturers may not be all inclusive and may be revised by the architect as needed.

B. The listing of an approved manufacturer is only for the purpose of stating that the company or entity listed is acceptable to provide the specified product if available in their "STANDARD" product line. The contractor shall not infer that ALL or ANY products supplied by this "approved" manufacturer are acceptable to this particular project. Any product supplied by an "approved" manufacturer MUST meet all requirements of the product specification as determined by the architect.

C. Any product submitted by an approved manufacturer but which does not meet the full requirements of the product specification in the determination of the architect may be rejected. The architect is the sole and final judge as to the acceptability of any product by an approved manufacturer.

1.04 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description as determined by the architect.

B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

D. Substitutions: Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor 10 days prior to receipt of bids are considered requests for substitutions.

E. The products described in the Proposal Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. The materials and equipment named in, and the procedures covered by these specifications have been selected as a standard because of quality, particular suitability or record of satisfactory performance. It is not intended to preclude the use of equal or better materials or equipment provided that same meets the requirements of the particular project and is approved in an Addendum as a substitution prior to the submission of proposals.

F. If any proposed substitution is approved prior to receipt of proposals, such approval will be set forth in an Addendum. Offerors shall not rely upon approvals made in any other manner.

G. **THE FOLLOWING ARE NOT CONSIDERED SUBSTITUTIONS:**

1. Substitutions requested by Bidders during the bidding period, and accepted prior to award of Contract, will be included in the Addenda and are considered as included in the Contract Documents.

2. Revisions to Contract Documents requested by the Owner or Architect.

3. Specified options of products and construction methods included in Contract Documents.

4. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

H. ONLY THE FOLLOWING OPTIONS MAY BE CONSIDERED AS A REASON FOR REQUEST OF A SUBSTITUTION.

1. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.

2. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or coordinate activities properly.

3. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

4. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other consideration of merit, after deducting offsetting responsibilities the Owner may he required to bear. These additional responsibilities shall include such considerations as additional compensation to the Architect/Engineer for redesign, redrawing and re-issuing of documents and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.

5. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

6. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

7. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.

I. THE FOLLOWING MAY <u>NOT</u> BE CONSIDERED AS A REASON FOR A REQUEST FOR SUBSTITUTION:

1. The contractor or sub-contractor prefers to use a product or method of construction not specified or previously accepted as an approved substitution in order to provide a cost advantage which is not offered to the Owner.

1.05 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. When it is discovered that specific products are available only from sources that do not or

cannot produce an adequate quantity to complete project requirements in a timely manner, consult with the Architect/Engineer for a determination of what product quantities are most important before proceeding. The Architect/Engineer will designate those qualities, such as visual, structural, durability, or compatibility that are most important. When the Architect/Engineer's determination has been made, select products from those sources that produce products that possess the most important qualities, to the fullest extent possible.

C. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two (2) or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

D. Where a proposed substitution involves the work of more than one (1) contractor, each contractor involved shall cooperate and coordinate the work with each other contractor involved, so as to provide uniformity and consistency and to assure the compatibility of, products.

1.06 SUBMITTALS

A. Substitution Request Submittal: Requests for substitution will be considered if received at least 10 days prior to bid date. Requests received after commencement of the Work may be considered or rejected at the discretion of the Architect.

1. Submit 3 copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.

2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:

a) Product Data, including Drawings and descriptions of products, fabrication and installation procedures.

b) Samples, where applicable or requested.

c) A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.

d) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, that will become necessary to accommodate the proposed substitution.

e) A statement indicating the substitution's effect on the Anticipated Project Schedule and Contract Construction Schedule after award of contract compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.

f) Cost information, including a proposal of the net change, if any, from the

specified product or assembly, or the contract sum.

g) Certification by the Bidder or Contractor that the substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become because of the failure of the substitution to perform adequately.

B. Architect's Action: If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the product specified by name. Acceptance of the proposed substitution will be in the form of an Addendum which lists all prior approved products prior to award of contract and a change order after the award of contract.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Conditions: The Bidder's or Contractor's substitution request will be received and considered by the Architect when all of the mandatory conditions are satisfied and one or more of the optional conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.

B. Mandatory Conditions:

1. Submitted as required prior to bidding.
2. Extensive revisions to Contract Documents are not required.
3. Proposed changes are in keeping with the general intent of Contract Documents.
4. The request is timely, fully documented and properly submitted.

C. Optional Conditions:

1. The request is directly related to an "or equal" clause or similar language in the Contract Documents.

2. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities property.

3. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

4. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner nay include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar considerations.

5. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Bidder or Contractor certifies that the substitution will overcome the incompatibility.

6. The specified product or method of construction cannot be coordinated with other

materials, and where the Bidder or Contractor certifies that the proposed substitution can be coordinated.

7. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Bidder or Contractor certifies that the proposed substitution provide the required warranty.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents,

E. The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

F. **FAILURE OF TIMELY ORDER - The contractor is responsible for assuring the timely order of all materials specified.** If a specified material, or color of material cannot be delivered by the contract completion date, due to failure to order the material in a timely manner, the contractor shall be responsible for supplying an equal or better material. The architect shall be the sole determinant of the approved substitute material. The contractor shall also be charged an amount equal to 5% of the value of the specified material. This amount shall be credited to the owner through a change order to the contract. The word "material", as used in this section, includes all items specified in the specifications or shown on the drawings.

2.02 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a contract requirement. These requirements may be specified in any one (1) of several different specifying methods, or in any combination of these methods. These methods include the following:

1. Proprietary
2. Descriptive
3. Performance
4. Compliance with Reference Standards: Compliance with codes, compliance with graphic details, allowances, and similar provisions of the Contract Documents also have a bearing on the selection process.

B. Procedures for Selecting Products: The Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations. They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects. Required procedures include, but are not limited to the following for the various indicated methods of specifying:

C. Proprietary and Semi-Proprietary Specification Requirements:

1. Single Product Name-. Where only a single product or manufacturer is named, provide the product indicated, unless the specification indicates the possible consideration of other products. Advise the Architect/Engineer before proceeding, when it is discovered that the named product is not a reasonable or feasible solution.

2. Two (2) or More Product Names: Where two (2) or more products or manufacturers are named, provide one (1) of the products named, at the Contractor's option. Exclude products that do not comply with specification requirements. Do not provide or offer to

provide and unnamed product, unless the specification indicates the possible consideration of other products. Advise the Project Manager and Architect/Engineer before proceeding where none of the named products comply with specification requirements, or are not feasible for use. Where products or manufacturers are specified by name, accompanied by the term "or approved equal" or similar language, comply with this Section regarding "substitutions" to obtain approval from the Architect/Engineer for the use of an unnamed product.

3. Non-Proprietary Specification Requirements: Where the specifications name products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to the use of these products only, the Contractor may, at his option, use any available product that complies with the Contract requirements.
4. Descriptive Specification Requirements: Where the specifications describe a product or assembly generically, in detail, listing the exact characteristics required, but without use of a brand name, provide products or assemblies that provide the characteristics indicated and otherwise comply with Contract requirements.

5. Performance Specification Requirements: Where the specifications require compliance with indicated performance requirements, provide products that comply with the specific performance requirements indicated, and that are recommended by the manufacturer for the application indicated. The manufacturer's recommendations may be contained in published product literature, or by the manufacturer's individual certification of performance. General overall performance of a product is implied where the product is specified for specific performances.

6. Compliance with Standards, Codes, and Regulations: Where the specifications require only compliance with an imposed standard, code or regulation, the Contractor has the option of selecting a product that complies with specification requirements, including standards, codes, and regulations.

7. Visual Matching: Where matching an established sample is required, the final judgment of whether a product proposed by the Contractor matches the sample satisfactorily will be determined by the Architect. Where there is no product available within the specified product category that matches the sample satisfactorily and also complies with other specified requirements, comply with the provisions of this Section regarding "substitutions" and other Contract Documents for "change orders" for the selection of a matching product in another product category, or for non-compliance with specified requirements.

8. Visual Selection: Except as otherwise indicated, where specified product requirements include the phrase "...as selected from the manufacturer's standard colors, patterns, textures..." or similar phrases, the Contractor has the option of selecting the product and manufacturer, provided the selection complies with other specified requirements. The Architect is subsequently responsible for selecting the color, pattern and texture from the product line selected by the Contractor.

9. Allowances: Refer to individual sections of the specifications and Section 01 21 00, Allowances for an indication of product selections that are controlled by established allowances, and for the procedures required for processing such selections.

10. Producer's Statement of Applicability: Where individual specification sections indicate products that require a "Statement of Applicability" from the manufacturer or other producer, submit a written-certified statement from the producer stating that the

producer has reviewed the proposed application of the product on the project. This statement shall state that the producer agrees with or does not object to the Architect/Engineer's specification and the Contractor's selection of the product on the project is suitable and proper.

PART 3 - EXECUTION

3.01 INSTALLATION OF APPROVED SUBSTITUTIONS

A. Coordinate all approved substitutions with adjacent work.

B. Comply with the manufacturer's and supplier's instructions and recommendations for installation of the products in the applications indicated.

C. Provide all items required by manufacturer and supplier regarding installation, i.e. supplemental supports, anchors, fasteners, painting, etc. whether or not indicated or specified.

3.02 SUBSTITUTION REQUEST FORM

A. All substitution requests shall be submitted to the Architect using the following form as and stipulated in the above requirements:

SUBSTITUTION REQUEST FORM **Page 1 of 2**

PROJECT: _____

LOCATION: _____

CONTRACTOR: _____

SUBMITTAL NO: _____

SUBMIT THE FOLLOWING INFORMATION:

1. Product, Fabrication or Installation Method to be replaced: _____

   _____

2. Related Specification Section and Drawing Number: _____

   _____

3. REASON FOR CHANGE: _____

   _____

4. ☐ Product Data Attached

   ☐ Samples Attached

5. Submit detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Qualities may include size, weight, durability, performance and visual effect.

6. List of changes / modifications required to other parts of the Work or construction performed by Owner and separate Contractors which will become necessary to accommodate the proposed substitution: _____

   _____

   _____

   _____

7. CHANGE IN PROJECT / CONSTRUCTION SCHEDULE IF SUBSTITUTION IS APPROVED:

   _____

   _____

8. CHANGE IN CONTRACT SUM IF SUBSTITUTION IS APPROVED: _____

   _____

SUBSTITUTION REQUEST FORM **Page 2 of 2**

9. By signing this form, the Bidder or Contractor certifies the following:

a. CONTRACTOR HAS THOROUGHLY INVESTIGATED AND COORDINATED THIS SUBSTITUTION AND CERTIFIES THAT IT MEETS OR EXCEEDS ORIGINAL PRODUCT/MANUFACTURER CALLED FOR IN THE CONTRACT DOCUMENTS.

b. CONTRACTOR HAS VERIFIED THAT THE CONTRACTOR/MANUFACTURER WILL PROVIDE THE SAME WARRANTY FOR THE SUBSTITUTION THAT THE CONTRACTOR WOULD FOR THAT SPECIFIED.

c. CONTRACTOR WAIVES ALL CLAIMS FOR ADDITIONAL COSTS RELATED TO THE SUBSTITUTION WHICH SUBSEQUENTLY BECOMES APPARENT.

d. CONTRACTOR WILL COORDINATE THE INSTALLATION OF THE ACCEPTED SUBSTITUTE MAKING SUCH CHANGES AS MAY BE REQUIRED FOR THE WORK TO BE COMPLETE IN ALL RESPECTS.

e. CONTRACTOR HAS VERIFIED THAT THE SUBSTITUTE'S PERFORMANCE AND OPERATION MEETS OR EXCEEDS ORIGINAL CALLED FOR IN CONTRACT DOCUMENTS.

f. CONTRACTOR HAS VERIFIED THAT SUBSTITUTE CAN BE INCORPORATED INTO PROJECT WITHOUT AFFECTING ANY OTHER ASPECT OF THE PROJECT.

g. CONTRACTOR UNDERSTANDS THAT ADDITIONAL TIME WILL BE REQUIRED FOR ARCHITECT/ ENGINEER PROCESSING AND OWNER'S CONSIDERATION OF SUBSTITUTION.

_____ _____
(CONTRACTOR AUTHORIZED REPRESENTATIVE) (DATE)

A/E's REVIEW AND ACTION

☐ Substitution Approved. Prepare submittals in accordance with Section 01 25 00 Product Substitution Procedures.

☐ Substitution Approved As Noted. Prepare submittals in accordance with Section 01 25 00 Product Substitution Procedures.

☐ Substitution Rejected. Substitution does not meet original specified product. Use specified materials.

☐ Substitution Rejected. Request received too late. Use specified materials.

By: _____ Date: _____

END OF SECTION 01 25 13

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing contract modifications.

1.02 MINOR CHANGES IN THE WORK

A. The Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on AIA Form G710, Architect's Supplemental Instructions.

1.03 CHANGE ORDER PROPOSAL REQUESTS (PR or CPR)

A. Owner-Initiated Proposal Requests: The Architect will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. Provide complete breakdown for all labor, materials and OH & P amounts. If necessary, the description will include supplemental or revised Drawings and Specifications.

B. Within 10 days of receipt of a proposal request, submit an estimate of cost necessary to execute the change to the Architect for the Owner's review.

C. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

D. Indicate delivery charges, equipment rental, and amounts of trade discounts. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

E. Contractor-Initiated Proposals: When latent or unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect in the form of a Change Proposal Request (CPR).

F. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change including all materials and labor and OH & P. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

G. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

H. Comply with requirements in Section "Product Substitutions" if the proposed change requires substitution of one product or system for a product or system specified.

I. Proposal Request Form: Use AIA Document G709 for Change Order Proposal Requests.

1.04 ALLOWANCES

A. Allowance Adjustment: For allowance-cost adjustment, base each Change Order Proposal on the difference between the actual purchase amount and the allowance, (multiplied by the final

measurement of work-in-place. Where applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.)

B. Include installation costs in the purchase amount only where indicated as part of the allowance.

C. When requested, prepare explanations and documentation to substantiate the margins claimed.

D. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.

E. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.

F. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or the Contractor's handling, labor, installation, overhead, and profit. Submit claims within 10 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. The Owner will reject claims submitted later than 14 days.

G. Do not include the Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in Contract Documents.

H. No change to the Contractor's indirect expense is permitted for selection of higher or lower-priced materials or systems of the same scope and nature as originally indicated.

1.05 ALLOWABLE GENERAL CONDITIONS COST

A. The following items are classified as General Conditions cost for the purpose of this contract:

1. PERSONNEL COSTS

a. Personnel costs include raw cost of base salary plus burden, including employer’s contribution to FICA and Medicare, FUI/SUI, and Workers’ Compensation, but not including bonuses, vacation, sick leave or other optional benefits.

b. Personnel billable under general conditions include the contractor’s superintendent, field engineer, and other field staff with prior approval of the District, the project manager for the actual hours worked on the project, the lead CPM scheduler, lead estimator or other individual directly responsible for project scheduling, bidding and buyout, and other individuals in the contractor’s organization only with the prior written approval of the Owner

B. The following costs will be permitted only at reasonable rates and with the specific prior approval of the Owner.

1. OTHER COSTS

a. Office trailer or other local office space for project site staff (unless provided by Owner).
b. Office furniture for project site office

c. Office supplies for project site office.
d. Telephone, fax equipment, hook-up and services for project site office
e. Internet hook-up and services (ONLY) for project site offices
f. Postage, UPS, FedEx and other deliveries
g. Bottled water.
h. Fire extinguishers
i. First aid kits
j. Safety materials
k. Temporary toilets (unless provided by Owner through existing facility)
l. Temporary utilities (unless hook-up and service provided by Owner through existing facility)
m. Temporary heat
n. Temporary lighting
o. Temporary fencing
p. Barricades, scaffolding
q. Protection of Work
r. Dust control.
s. Storm Water Pollution Prevention Program
t. Storage containers
u. Dumpsters
v. Rental of material handling equipment
w. General Cleanup.

1.05 CONSTRUCTION CHANGE DIRECTIVE (CCD)

A. Construction Change Directive: When the Owner and the Contractor disagree on the terms of a Proposal Request or when Work is authorized and payment for which shall be from the Contingency Allowance, the Architect may issue a Construction Change Directive on AIA Form G714. The Construction Change Directive instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order or Contingency Expenditure Authorization.

B. The Construction Change Directive contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.

C. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

D. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.06 CONTINGENCY EXPENDITURE AUTHORIZATION (CEA)

A. Contingency Expenditure Authorization is a document that authorizes and tracks the expenditure of funds from the Owner's Contingency Allowances, Betterment Allowance and all other allowances as listed in Section 01 21 00 Allowances.

B. Documentation for proposed contingency expenditures shall be submitted is the same manner, form and content as if the work is to be submitted as a Change Order. Additional mark-up (OH & P) shall not be included in contingency expenditure allowances since these amounts were included in the contract price.

C. All contingency expenditures must be approved by the Owner and architect. If time is critical, Architect may provide written authorization for Contractor to proceed with work to be included in next allowance expenditure authorization.

1.07 CHANGE ORDER PROCEDURES

A. Upon the Owner's approval of a Proposal Request that impacts the contract sum or schedule, the Architect will issue a Change Order for signatures of the Owner and the Contractor on AIA Form G701.

PART 2 - NOT APPLICABLE

PART 3 - NOT APPLICABLE

END OF SECTION 01 26 00

SECTION 01 29 00 SCHEDULE OF VALUES & PAYMENT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

B. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, Submittal Schedule, and List of Subcontracts.

1.02 ALLOWABLE GENERAL CONDITIONS COSTS

A. Personnel Costs

1. Personnel costs include raw cost of base salary plus burden, including employer's contribution to FICA and Medicare, FUI/SUI, and Workers' Compensation, but not including bonuses, vacation, sick leave or other optional benefits.

2. Personnel billable under General Conditions include the contractor's field superintendent, field engineer, and other field staff with prior approval of the District, the project manager for the actual hours worked on the project, the lead CPM scheduler, lead estimator or other individual directly responsible for project scheduling, bidding and buyout, and other individuals in the contractor's organization only with prior written approval of the District.

B. Other Costs

1. The following costs will be permitted only at reasonable rates and with specified prior approval of the District:

a. Office trailer or other local office space for project site staff.

b. Office furniture for project site office

c. Office supplies for project site office

d. Telephone equipment, hook-up and services for project site office including site internet service.

e. Computer hardware, fax machine, copy machine and other equipment for site office as approved by the district in advance.

f. Postage, UPS, FedEx and other deliveries

g. Bottled water; fire extinguishers; first aid kits

j. Safety materials

k. Project signs for contractor or subs

l. Temporary toilets, Temporary power, Temporary Heat, Temporary fire protection, Temporary Lighting and Temporary Fencing

m. Weather protection; Winterization of site

o. Barricades; Scaffolding

q. Protection of Work

r. Survey Controls and Building Layout

s. Materials Testing

t. Dust control

u. Storm Water Pollution Prevention (SWPP) Program

v. Storage Containers and Dumpsters

w. Rental of material handling equipment

x. General Clean up

1.03 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule. Prepare separate Schedule of Values for each of the Additions and Renovations projects. AIA Form G702 and G703 may be use as schedule of values format.

B. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:

1. Contractor's Construction Schedule.
2. Application for Payment forms, including Continuation Sheets.
3. List of subcontractors.
4. Schedule of allowances.
5. Schedule of alternates.
6. List of products.
7. List of principal suppliers and fabricators.
8. Schedule of submittals.

C. Submit the Schedule of Values to the Architect at the earliest possible date but no later than 14 days after date of Authorization to Proceed or start of construction.
1. The Schedule of Values will be reviewed by the Architect and Owner.
2. Contractor will revise the Schedule of Values to the satisfaction of the Architect and Owner.
3. Once Architect and Owner approve the submitted Schedule of Values, provide Architect an Excel file of the Schedule of Values.

D. Sub-schedules: Where Work is separated into phases requiring separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

E. Format and Content: Use the Project Manual table of contents as a guide to establish the format for the Schedule of Values. Provide at least one line item for each Specification Section. Provide cost breakdown for each line item for cost of labor and cost of materials.

F. Identification: Include the following Project identification on the Schedule of Values:
1. Project name and location.
2. Name of the Architect.
3. Project number.
4. Contractor's name and address.
5. Date of submittal.

G. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
1. Related Specification Section
2. Description of Work.
3. Name of subcontractor.
4. Name of manufacturer or fabricator.
5. Name of supplier.
6. Change Orders (numbers) that affect value.
7. Dollar value of material
9. Dollar value of labor
10. Percentage of Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

H. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.

I. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

J. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed.

K. Differentiate between items stored on-site and items stored off-site. Include requirements for insurance and bonded warehousing, if required.

L. Provide separate line items on the Schedule of Values for labor and material including initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

M. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

N. Margins of Cost: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

O. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.

P. Schedule Updating: Update and resubmit the Schedule of Values prior to the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum. List each Change Order as a separate line item.

1.04 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.

B. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional submittal requirements.

C. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.

D. Payment-Application Forms: Use AIA Document G702 and Continuation Sheets G703 as the form for Applications for Payment.

E. Application Preparation: Complete every entry on the form. Include notarization and execution by a person authorized to sign legal documents on behalf of the Contractor. The Architect will return incomplete applications without action.

F. Entries shall match data on the Schedule of Values and the Contractor's Construction Schedule. Use updated schedules if revisions were made.

G. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

H. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to the Architect by a method ensuring receipt within 24 hours. One copy shall be complete, including waivers of lien and similar attachments.

I. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Architect.

J. Waivers of Mechanics Lien: With each Application for Payment, submit waivers of mechanics lien from every entity who is lawfully entitled to file a mechanics lien arising out of the Contract and related to the Work covered by the payment.

K. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.

L. Submit final Applications for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

M. The Owner reserves the right to designate which entities involved in the Work must submit waivers. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to the Owner.

N. **INITIAL APPLICATION FOR PAYMENT**: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment, include the following:

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Schedule of Values.
4. Contractor's Construction Schedule (preliminary if not final).
5. Schedule of principal products.
6. Schedule of unit prices.
7. Submittal Schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. Copies of building permits.
10. Copies of authorizations and licenses from governing authorities for performance of the Work.
11. Initial progress report.
12. Report of preconstruction meeting.
13. Certificates of insurance and insurance policies.
14. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment.

O. **SUBSTANTIAL COMPLETION APPLICATION FOR PAYMENT**: This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Administrative actions and submittals that shall precede or coincide with this application include:

1. Certificate of Occupancy and similar approvals.
2. Warranties (guarantees) and maintenance agreements.
3. Record Documents.
4. Test/adjust/balance records.

5. Maintenance instructions.
6. Meter readings.
7. Startup performance reports.
8. Changeover information related to Owner's occupancy, use, operation, and maintenance.
9. Final cleaning.
10. Advice on shifting insurance coverages.
11. List of incomplete Work (punch list), recognized as exceptions to Architect's Certificate of Substantial Completion.

P. **FINAL APPLICATION FOR PAYMENT**: Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Ensure that unsettled claims will be settled.
4. Ensure that incomplete Work is not accepted and will be completed without undue delay.
5. Transmittal of required Project construction records to the Owner.
6. Proof that taxes, fees, and similar obligations were paid.
7. Removal of temporary facilities and services.
8. Removal of surplus materials, rubbish, and similar elements.
9. Change of door locks to Owner's access.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 29 00

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, specifications, and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Administrative and supervisory personnel.
   3. Requests for Information (RFIs).
   4. Project meetings.

B. Related Sections:
   1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   2. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.4 COORDINATION

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Pre-installation conferences.
   7. Project closeout activities.
   8. Startup and adjustment of systems.

1.5 KEY PERSONNEL

A. Key Personnel Names: Within ten (10) days following Notice to Proceed, submit a list of key personnel per submittal procedures in 01 33 00, including superintendent and other personnel in attendance at Project site. Identify individuals; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses.
    1. Post copies of list in project meeting room, in temporary field office, in construction safety manual, and provide copies electronically to AE, owner's representative or others upon request. Keep list current at all times.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified using the Program Manager's electronic project management software.
    1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
    2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
    3. Contractor uses the RFI to request direction and/or clarification resulting from, but not limited to the following:
        a. Conflicts, omissions, ambiguities, or discrepancies within the Contract Documents
        b. Conflicts between the Contract Documents and any provision of code or regulation applicable to the performance of the work
        c. Conflicts between the Contract Documents and any standard specification or instruction of a manufacturer
        d. Conflicts with differing existing conditions.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
    1. Project name.
    2. Project number.
    3. Date.
    4. Name of Contractor.
    5. Name of Architect.
    6. RFI number, numbered sequentially.
    7. RFI subject.
    8. Specification Section number and title and related paragraphs, as appropriate.
    9. Drawing number and detail references, as appropriate.
    10. Field dimensions and conditions, as appropriate.
    11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
    12. Contractor's signature.
    13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
        a. Include dimensions, thicknesses, structural grid references, and

details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form generated using Owner's designated software (Prolog) with substantially the same content as indicated above

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.
      d. Requests for adjustments in the Contract Time or the Contract Sum.
      e. Requests for interpretation of Architect's actions on submittals.
      f. Incomplete RFIs or inaccurately prepared RFIs.
   2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
   3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing via the owner's designated software within seven (7) days of receipt of the RFI response.

E. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.

F. RFI Log: Prepare, maintain, and submit on a weekly basis a log of RFI's organized by the RFI number. The log should be generated using the Owner's designated software (Prolog).

1.7 PROJECT MEETINGS

A. Preconstruction Conference: Architect and Project Manager will schedule and conduct a preconstruction conference at the earliest possible date after the execution of the Agreement and before starting construction, at a time convenient to Owner, PM and Architect.
   1. Purpose of the conference will be to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner, PM, Architect, and their consultants; Contractor and its superintendent; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect progress, including any or all of the following:

a. Introductions
b. Submission of Post Proposal Information if any outstanding
c. Tentative Construction schedule.
d. Meetings: dates, locations, attendees, types, agendas
e. Communication: Owner's representative electronic project management software, correspondence flow
    1) Lines of communications
f. Schedule:
    1) Phasing
    2) Critical work sequencing and long-lead items
g. Designation of key personnel and their duties
h. Procedures for processing field decisions and Change Orders
i. Procedures for RFIs
j. Consultant / Lab Notification Requirements
    1) HazMat
    2) Roofing
    3) Test & Balance
    4) Materials Testing
    5) Inspecting
k. Procedures for processing Applications for Payment
    1) Schedule of Values
    2) Review
    3) SBE
l. Distribution of the Contract Documents.
m. Submittal procedures.
n. Preparation of record documents.
o. Use of the premises and existing building
p. Work restrictions.
q. Working hours.
r. Owner's occupancy requirements.
s. Responsibility for temporary facilities and controls.
    1) Site access
    2) Signage
    3) Dumpsters
    4) Fencing
    5) SWPPP
    6) Parking availability
    7) Office, work and storage areas
    8) Equipment deliveries and priorities
t. Procedures for disruptions and shutdowns.
u. Safety
    1) Emergency Contact List
    2) First aid.
    3) Site Security.

v. Progress cleaning.

4. Minutes: Architect will record and distribute meeting minutes using the Program Manager's electronic project management software.

B. Progress Meetings: The architect and the Project Manager will schedule and administer progress meetings at weekly intervals.
   1. Contractor shall make physical arrangements at site for the progress meetings.
   2. Location of meetings: Contractor's field office, unless agreed upon mutually by the Architect, Contractor and PM.
      a. Determine at the Pre-construction Meeting if space in the existing facility or facilities is available for meetings.
      b. For multiple school Bid Packages, weekly progress meetings will be held at each school site on a rotating basis. Site specific meetings will be held at the discretion of the PM.
   3. AE will prepare agenda, distribute notice of the meeting, PM will preside at meetings. AE will record minutes and distribute copies within five (5) days after meeting to participants, and to entities affected by decisions at meetings. Distribution will come from owner's software or email.
   4. Coordinate dates of meetings with preparation of payment requests.
   5. Attendees:
      In addition to representatives of Owner, Owner's representative, Professional Consultants, as appropriate to the agenda, and Architect, each contractor, job superintendent, subcontractor, supplier, and other entities as appropriate to the agenda shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   6. Agenda will contain some or all of the content below:
      a. Review and correct or approve minutes of previous progress meeting.
      b. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
         1) Safety (lost time, accidents, violations, etc.)
         2) Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
            a) Review schedule for next period.

3) New Business (Field observations, problems, decision, identification of problems which impeded planned progress, non-confirming work, etc.)
4) RFI's and RFI log review
5) Submittals and submittal log review
6) RFP's, CAEAs and related log reviews
7) Review of draft Application for Payment, as necessary.
8) For new schools: LEED Certification status and strategy.

c. Review present and future needs of each entity present, including the following:
1) Interface requirements.
2) Sequence of operations.
3) Access.
4) Site utilization.
5) Temporary facilities and controls.
6) Progress cleaning.
7) Quality and work standards.
8) Status of correction of deficient items.
9) Field observations.
10) Pending claims and disputes.

7. Minutes: Using the Owner's designated software (Prolog), the entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

C. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner, PM, and Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following as applicable:
a. Contract Documents.
b. Related RFIs.
c. Submittals.
d. Review of mock-ups.
e. Possible conflicts.
f. Compatibility problems.
g. Time schedules.
h. Weather limitations.
i. Manufacturer's written recommendations.
j. Warranty requirements.
k. Compatibility of materials.

l. Acceptability of substrates.
m. Space and access limitations.
n. Testing and inspecting requirements.
o. Installation procedures.
p. Coordination with other work.
q. Required performance results.
r. Protection of adjacent work.
s. Protection of construction and personnel.
t. For new schools: LEED Certification status and strategy.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Reinstallation Conference: When required in individual Specification Sections, convene a reinstallation conference at work site prior to commencing work of the section.
1. Require attendance of entities directly affecting or affected by Work of the Section.
2. Notify Owner, PM and Architect at least seven (7) days in advance of meeting date.
3. GC shall prepare agenda, preside at conference, record minutes, and distribute copies within five (5) days after conference to participants.
4. Review conditions of reinstallation, preparation and installation procedures, and coordination with related work.

E. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner, Owner's representative and Architect, but no later than thirty (30) days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Owner's representative, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following: Preparation of record documents.
a. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
b. Submittal of written warranties.
c. Requirements for preparing operations and maintenance data.
d. Requirements for demonstration and training.

e. Preparation of Contractor's punch list.
f. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
g. Submittal procedures.
h. Responsibility for removing temporary facilities and controls.
i. Review of General Contractor Close Out Checklist (see Part 3 – Execution)
j. Commissioning
k. Testing and Balancing.

4. Minutes: Architect will record and distribute meeting minutes using the Owner's designated software (Prolog).

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

3.1 The General Contractor Close-out checklist will be completed by the owner's representative and general contractor. A copy will be submitted with the substantial completion AIA G704 and the certificate of final completion. The owner's representative will disrupt the most current version of the general contractor close-out checklist.

End of Section 01 31 00

General Contractor Close-out Checklist - Information for Auditor

To: <<Name>> Project Manager, Fort Bend ISD **Date:**
GC: <<Name of GC Firm>> **A/E Firm:** <<Name of A/E Firm>>
Org#: xxx **PM:** <<Name of PM Firm>>
School Name:
Project Type: ☐ Addition ☐ Renovations ☐ New Construction

Item #	Document Description	Primary Responsibility	Tab #	Check-Off	Remarks
I.	**FINANCIAL RECONCILIATION / FINAL PAYMENT REQUIREMENTS**				
a.	Copies of Reconciliation to FBISD Financial System and Copy of Final Payment	PM			PM will collect for close-out
b.	Certificate(s) of Insurance including General Liability and (Pollution and/or Professional Liabilty if/applicable)	PM			PM will collect for close-out
c.	Insurance Requirements at Final Completion Statement	PM			PM will collect for close-out
d.	Copy of Final Change Order	PM			PM will collect for close-out
e.	Copies of all executed Change Orders	PM			PM will collect for close-out
f.	Copies of all executed CAEAs and CAELs	PM			PM will collect for close-out with back-up information
g.	Copies of all executed AERAs	PM			PM will collect for close-out with back-up information
h.	Copies of all executed custodian overtime authorizations (Summary Recap (Hrs.)	PM			PM will collect for close-out. Include as deductive CAEA
i.	Confirmation of back charge for project-talk licenses & Custodian Overtime	PM			PM will collect for close-out. Include as deductive CAEA
j.	Confirmation of back charge for technology refund (ERATE), if applicable	PM			PM will collect for close-out. Include as deductive CAEA
k.	SBE Contract Closeout Evaluation Form	PM			PM will collect for close-out. Include final M/WBE payment status report.
II.	**PAYMENT AND PERFORMANCE BONDS**				
a.	"Consent of Surety Company to Final Payment"; AIA G707 (Confirm that Power of Attorney is attached to form.)	GC			
III.	**EVIDENCE OF PAYMENT OF DEBTS AND CLAIMS**				
a.	"Contractor's Affidavit of Payment of Debts and Claims" AIA G706	GC			
IV.	**SUBSTANTIAL COMPLETION**				
a.	AIA G704 - Certificate of Substantial Completion	A/E FBISD PM			
b.	Punchlist - Issued at substantial completion	GC			
c.	Exhibit G - Form of Substantial Completion Certification	A/E			This is an Exhibit in the A/E Agreement
V.	**FINAL COMPLETION**				
a.	Exhibit H - Form of Final Competion Certification - with signed off punchlist	A/E			This is an Exhibit in the A/E Agreement
b.	TDLR - RAS report approved or A/E Letter	A/E			If the RAS report shows deficiencies, the A/E will have to confirm/explain and/or justify corrections.
c.	Attachment C - Form of Program Manager's Final Completion Certificate	PM			This is an Exhibit in the PM Agreement
d.	Exhibit D - Form of Contractor's Final Completion Notice	GC			
e.	TEA - Certification of Project Compliance	A/E GC FBISD PM			PM will coordinate the sign-off on this document.
VI.	**OPERATIONS AND MAINTENANCE MANUALS AND EVIDENCE OF TRAINING**				
a.	A/E's O&M Manuals confirmation letter.	GC			
b.	O&M Manuals submitted by GC to A/E	GC			Per detailed list developed by GC and reviewed by A/E and PM. One Manual per each school to be split by CSI Divisions
c.	Training Matrix, Sign-In sheet(s) and DVDs.	GC			GC is to provide a sign-in sheet for each system for which training has been provided to indicate the person, title and date of completion of the training.
VII.	**ATTIC STOCK / SPARE MATERIAL / KEY TRANSFER**				
a.	Signed off Transmittal Attic stock & spare material	GC			Provided by GC and received by Principal or Campus Facility Supervisor or Maintenance, as applicable
b.	Signed off Transmittal Key transfer (Accessory keys)	GC			Provided by GC and received by Principal or Campus Facilities Supervisor, as applicable.
VIII.	**WARRANTIES - By SYSTEM (MEP, Fire alarm, Fire sprinkler, Roofing, Security, etc.)**				
a.	Exhibit B - Form of Contractor's Guarantee	GC			
b.	Exhibit B-2- Certification of Compliance with Contract Documents.	GC			
c.	Manufacturer's Warranty(ies)	GC			A separate "Warranties" manual should be provided for guarantees, warranties, etc.
d.	List of Subcontractors and Suppliers	GC			

Item #	Document Description	Primary Responsibility	Tab #	Check-Off	Remarks
IX.	**LOCAL AGENCIES APPROVALS (as applicable)**				
a.	City - Certificate of Occupancy	GC			
b.	City - Final Inspections (Building)	GC			Green tags colored copies
c.	Storm Water Prevention Polution Plan, SWPPP	GC			
d.	Elevator Inspection Certificate	GC			
e.	Boiler Inspection Certificate	GC			
f.	Health Department Inspection Certificate	GC			
X.	**RECORD DOCUMENTS (DRAWINGS, SPECIFICATIONS, ETC.)**				
a.	Record Documents transmittal from GC to A/E	GC			GC is to update red-lined record drawings on a monthly basis. Final red-line record set to be provided to A/E.
b.	A/E's receipt of Record Documents Letter	A/E			A/E is to provide a letter indicating that all record documents have been provided by the G.C.
XI.	**GC DESIGNED DOCUMENTS**				
a.	Fire Alarm drawings	GC			Need Govermental Agency approved documents.
b.	Security drawings	GC			
c.	HVAC Controls drawings	GC			
d.	Fire Sprinkler System drawings	GC			Need Govermental Agency approved documents.
e.	Data Cabling drawings	GC			
XII.	**CERTIFICATIONS**				
a.	Certification of Asbestos Free Project: Letter from GC as per AIA A201 13.11.1	GC			
b.	Certification of Lead-Free Potable Water System: Letter from GC as per AIA A201 13.12.1.	GC			
XIII.	**FINAL SYSTEM REPORTS**				
a.	Final Test & Balance Report	T&B			
b.	Final Roof Inspection Report	Roof Inspector			
c.	Final HVAC Controls - CMCS Report	FBISD Facilities			
XIV.	**WARRANTY INSPECTIONS**				
a.	6 month inspection shall be conducted no later than: <<Date>>				
b.	11 month inspecton shall be conducted no later than: <<Date>>				
XV.	**ACKNOWLEDGE STATEMENT**				
a.	Project Completion Acknowledgement - Signed and dated by School Principal	PM			
b.	Project Completion Notification to FBISD Facilities.	FBISD Project Manager			

I have submitted the close-out documentation in compliance with applicable contract:

G.C. Firm _____ Print Name _____ Signature _____ Date _____

I have reviewed and acknowledge receipt of the close-out documentation submitted by the General Contractor and found it complete and in compliance with applicable contracts:

A/E Firm _____ Print Name _____ Signature _____ Date _____

I have reviewed and acknowledge receipt of the close-out documentation submitted by the General Contractor and the A/E and found it complete and in compliance with applicable contracts:

Program Manager _____ Print Name _____ Signature _____ Date _____

I have reviewed and acknowledge receipt of the close-out documentation submitted by the General Contractor, A/E and PM and found it complete and in compliance with applicable contracts:

Fort Bend Independent School District
Owner _____ Print Name _____ Signature _____ Date _____

SECTION 01 31 15 PROJECT MANAGEMENT COMMUNICATIONS - CONTRACTOR

PART 1 - GENERAL

1.01 PROJECT MANAGEMENT COMMUNICATIONS

1.01.1 Project communications will utilize the Internet web-based Project Communications Software, E-Builder® ASP software, and protocols included in that software. The use of the Project Management Communications website as herein described does not replace or change any contractual responsibilities of the participants.

1.01.1.1 Purpose: The intent of using the Project Management Communications website is to improve project workflow bypromoting timely initial communications and responses. Additionally, the Project Management Communications website reduces the number of paper documents while providing improved record keeping by creation of electronic document files.

1.01.1.1.1 Document Integration: Documents of various types shall be logically related to one another and discoverable. For example, requests for information, daily field reports, supplemental sketches and photographs shall be capable of reference as related records.

1.01.1.1.2 Reporting: The system shall be capable of generatingreports for work in progress, and logs for each document type. Summary reports generated by the system shall be available for team members.

1.01.1.1.3 Notifications and Distribution: Document distribution to project members shall be accomplished both within the extranet system and via email as appropriate. Project document distribution to parties outside of the project communication system shall be accomplished by secure email of outgoing documents and attachments, readable by a standard email client.

1.01.2 Required Software: The Contractor shall maintain their own licenses for the Project Communications Software, E-Builder. The Contractor will be required to purchase and maintain at least one license. The annual cost of the user license for Lamar CISD is $1,546.00. Each license is good for 1 year from the date of purchase, you will receive a notice 30 days prior to expiration of each license. Contractor shall maintain at least one license from the date of the Notice to Proceed, through to approval for the Final Payment of the Construction contract.

1.01.2.1 Training: Users will be required to attend a training sessionscheduled by the Program Manager.

1.01.2.2 Support: The Project Communications Software provides on-going support through on-line help files.

1.01.2.3 Project Archive: Upon project completion or at intervals during the

project, all related all project related documents accessible to the Contractor and forms can be archived by the software provider for a minimal fee if the Contractor would like a copy of all the documents, processes and workflow form data. All legal rights in any discovery process are retained. 1.2.5 Copyrights and Ownership: Nothing in this specification or the subsequent communications supersedes the parties' obligations and rights for copyright or document ownership as established by the Contract Documents. The use of CAD files, processes or design information distributed in this system is intended only for the project specified herein.

1.01.2.4 Authorized Users: Access to the web site will be by individualswho are licensed users.

1.01.2.4.1 User Application will be provided upon request.

1.01.2.4.2 Submit a completed user application form to the Program Manager.

1.01.2.4.3 Authorized users will be contacted directly by the software provider, who will assign the temporary user password.

1.01.2.4.4 Individuals shall be responsible for the proper use of their passwords and access to data as agents of the company in which they are employed.

1.01.2.4.5 DO NOT POST PRIVATE OR YOUR COMPANY CONFIDENTIAL ITEMS IN THE DATABASE!

1.01.2.5 Each of the above Contractor computers using the Project Communications Software shall have the minimum system, software and internet connection requirements identified by the software provider.

1.01.2.5.1 Desktop and Laptop configurations should be equal to or exceed minimum system requirements. Operating System: Windows XP or newer Internet Browser: Internet Explorer 6.01SP2+ (Recommend IE7.0+) Minimum Recommend Connection Speed: 256K or above Processor Speed: 1 Gigahertz and above RAM: 512 mb

1.01.3 Communications: Project Management Communications Software shall be utilized to file and when issuing and responding to the following documents/actions:

1.01.3.1 Accident Reports

1.01.3.2 Action Items

1.01.3.3 Architect/Engineer Field Observations

1.01.3.4 Architect's Supplemental Instructions

1.01.3.5 Commissioning Issues

1.01.3.6 Construction Change Directive

1.01.3.7 Construction Bulletins

1.01.3.8 Construction Photographs

1.01.3.9 Contractor's Daily Log

1.01.3.10 Contractor's Notification of Change

1.01.3.11 Daily Observation Reports

1.01.3.12 Design Review

1.01.3.13 Drawings and Specifications

1.01.3.14 Geotechnical reports and test results

1.01.3.15 Inspection Reports

1.01.3.16 Meeting Minutes and meeting minutes action items

1.01.3.17 Meeting Minutes Action Item

1.01.3.18 Memo

1.01.3.19 Non-Conformance Notice

1.01.3.20 Notice of Intent to Perform Work

1.01.3.21 Notification of Non-Compliance

1.01.3.22 Owner's Daily Log

1.01.3.23 Payment Application Review

1.01.3.24 Personnel Injury Report

1.01.3.25 Plan Change Request

1.01.3.26 Project Change Notice

1.01.3.27 Proposal Request, Proposed Change and Architectural Supplemental Instructions

1.01.3.28 Punch list

1.01.3.29 Quality Control Notice

1.01.3.30 RFI, Request for Information

1.01.3.31 Request for Shutdown

1.01.3.32 Request for Substitution

1.01.3.33 Safety Violation

1.01.3.34 Schedules

1.01.3.35 Submittals review, including record numbering by drawing and specification section

1.01.3.36 Supplemental Sketches

1.01.3.37 SWPPP Inspection

1.01.3.38 Test results including materials

1.01.3.39 Transmittals, including record of documents and materials delivered in hard copy

1.01.4 Document management: When paper documents require original signatures, they shall be submitted in both original format and electronic form to the Project Management Communications website web site by licensed users.

1.01.4.1 The Owner and his representatives, the General Contractor and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier shall respond to documents received in electronic form on the web site, and consider them as if received in paper document form.

1.01.4.2 The Owner and his representatives, the General Contractor and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier reserves the right to and shall reply or respond by transmissions in electronic form on the web site to documents actually received in paper document form.

1.01.4.3 The Owner and his representatives, the General Contractor and his representatives, the Architect and his consultants, and the Contractor and his sub-contractors and suppliers at every tier reserves the right to and shall copy any paper document into electronic form and make same available on the web site.

1.01.4.4 The following are some but not all of the paper documents requiring original signatures:

Contracts
Proposed
Changes
Change
Orders
Application & Certificates for Payment

END OF SECTION 00 74 00

SECTION 01 31 19
PROJECT MEETINGS

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDE

A. The Architect's:
1. Scheduling of each meeting (pre-construction meeting, periodic project meetings, and specialty called meetings throughout the progress of the Work).
2. Preparation of agenda for meetings.
3. Presiding at minutes, including all significant proceedings and decisions.
4. Recording, reproducing, and distributing copies of meeting minutes within two (2) working days, excluding weekends and holidays, after each meeting to:
   a. All participants in the meeting.
   b. All parties affected by decisions made at the meeting.
5. Providing status report of allowance funds.

B. The Contractor's:
1. Making physical arrangement for meetings.
2. Participation in all meetings and conferences.
3. Scheduling attendance of Job Superintendent, Project Coordinator, and other parties affecting or affected by decisions made at meetings and conferences as their interests require.
4. Scheduling Pre-installation conferences.
5. Scheduling Pre-Closeout Meeting
6. Providing updated schedules.
7. Providing status reports/logs of CPRs, MCs, and shop drawings/submittals.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION CONFERENCE

A. Contractor shall contact Architect at least ten (10) days prior to commencing construction in order for Architect to schedule a pre-construction meeting with Contractor, Architect, and Owner. This meeting must occur prior to commencement of any construction.

B. Architect will:
1. Administer pre-construction conference for the establishment of communication methods, procedures and Owner requirements.
2. Administer site mobilization conference for clarification of Owner and Contractor.

C. Location: At Project site as designated by the Architect.

D. Attendance:
1. Contractor or Contractor's Representatives
2. Job Superintendent
3. Project Coordinator (Manager)

4. Owner or Owner's Representative
5. Major subcontractors
6. Major suppliers
7. Architect's Representative
8. Others as appropriate

E. Meeting Agenda, may include, but is not limited to:
1. Discussion on major subcontracts and suppliers and projected construction schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities. Discussion of long lead time items.
4. Project coordination and designation of responsible personnel.
5. Procedures and processing of field decisions, proposal requests, submittals, minor changes, change orders and applications for payment.
6. Method of distribution of Contract Documents.
7. Procedures for maintaining Record Documents.
8. Use of premises, office work and storage areas, on-site parking, and Owner's requirements.
9. Construction facilities and temporary utilities.
10. Housekeeping procedures.

3.2 PROGRESS MEETINGS

A. Architect will:
1. Schedule project meetings throughout progress of the work at weekly intervals, and specially called meetings.
2. Set agenda and administer said meetings.
3. Preside at meetings.
4. Record meeting minutes, including all significant proceedings and decisions.
5. Reproduce and distribute copies of meeting minutes within two (2) working days, excluding weekends and holidays, after each meeting to:
   a. All participants in the meeting.
   b. All parties affected by decisions made at the meeting.

B. Architect shall:
1. Make physical arrangements for meetings.

C. Attendance:
1. Contractor or Contractor's Representative
2. Job Superintendent
3. Project Coordinator (Manager)
4. Owner or Owner's Representative
5. Major subcontractors
6. Major suppliers
7. Architect's Field Representative
8. Consultants as needed
9. Others as appropriate

D. Meeting Agenda, may include, but is not limited to:
1. Review and approval of minutes of previous meeting.
2. Review of Work progress since previous meeting.
3. Field observations, problems, and conflicts.
4. Review of off-site fabrication and delivery schedules.
5. Corrective measures and procedures to regain projected schedule.
6. Revisions to Construction Schedule.
7. Plan progress and schedule during succeeding work period.
8. Coordination of schedules.
9. Review submittal schedules and expedite as required.

10. Maintenance of quality standards.
11. Allowance balances.
12. Review of proposed changes and substitutions for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the Project.
13. Status of Allowance Expenditure Authorizations (AEAs).
14. Status of Change Proposal Requests (CPRs).
15. Status of Minor Changes (MCs).
16. Status of submittals, review of submittal log.
17. Other items and critical issues affecting Work.

3.3 PRE-INSTALLATION CONFERENCES

A. In accordance with the requirements of Section 01 11 00, Notification of Architect Requirements, the Contractor will convene pre-installation conferences when required by individual specification Sections or as required by the Architect, prior to the Contractor commencing Work of the Section.

B. Attendance, optional:
1. General Contractor or Contractor's Representative
2. Project Coordinator (Manager)
3. Owner or Owner's Representative
4. Architect's Project Manager (Project Executive)

C. Attendance, required:
1. Project Superintendent
2. Architect's Field Representative
3. Sub-contractor's Project Manager
4. Sub-contractor's Foreman
5. Engineer's Representative, as needed.
6. Manufacturer's Representative, as needed.
7. Governing Agency Official, as required
8. Inspection Agency Representative, as required.
9. Others affecting or affected by Work.

D. Meeting Agenda, may include, but is not limited to:
1. Review of conditions of installation.
2. Preparation and installation procedures.
3. Coordination with related work
4. Review of the contract document requirements.
5. Review of code enforcement or testing requirements.
6. Questions related to work required.

3.4 PRE-CLOSEOUT MEETING

A. In accordance with the requirements of Section 01 77 00, Closeout Procedures, the Contractor will convene a pre-closeout meeting when he considers the Work or designated portion of the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the work for its intended use.

B. Attendance, required:
1. Owner or Owner's Representative
2. Project Coordinator (Manager)
3. General Contractor or Contractor's Representative
4. Project Superintendent
5. Architect's Project Manager (Project Executive)
6. Architect's Field Representative

7. Engineer's Representative, as needed.

C. Meeting Agenda, may include, but is not limited to:
1. Review of the contract document requirements for Substantial Completion and Project Closeout
2. Review of Work which remains to be completed or corrected.
3. Closeout Document review schedule and log
4. Review of closeout procedures including, but not limited to Record Drawings, Warrantees, Operation and Maintenance Manuals, and Owner Demonstrations and Start-up.
5. Review of code enforcement or testing requirements.
6. Questions related to work required.

3.5 PRE-INSTALLATION CONFERENCES

A. Contractor shall convene pre-installation conferences for all applicable scopes of work listed below. All applicable pre-installation conference dates shall be included in the project progress schedules submitted with the monthly application for payment.

Division 1 - General Requirements
Survey
Geotechnical Boring Logs
SUE -Subsurface Utility Engineering
Site Laydown and Utilization
Validation of AHJ (Municipality, MUD,SUD)
Validation of long lead items
Schedule Validation (Campus Event Coordination)

Division 2 - Site Work
SWPPP
Underground Storm
Electrical Primary and Data Communications Ductbanks
Sanitary Sewer System/Water
Irrigation and Landscaping
Natural Gas

Division 3 - Concrete
Foundation Systems
Paving and Flatwork
Elevated Concrete

Division 4 - Masonry
Structural Masonry
Veneer Masonry
Partition Masonry

Division 5 - Metals
Structural Steel
Ornamental Metal
Division 5 and 8 Coordination

Division 6 - Woods, Plastics, Composites
Blocking
Millwork

Division 7 - Thermal & Moisture Waterproofing Protection
Roofing
Fireproofing
Insulation

Division 8 - Openings
Windows
Doors and Hardware

Division 9 - Finishes
Flooring Systems
Wall Finishing Systems
Ceiling Systems
MEP Coordination for Division 9 Items

Division 10 - Specialties
Supergraphics Validation
MEP Coordination for Division 10 Items

Division 11 - Equipment
Coordination with Divisions 3, 15 and 16
Playground
ADA Equipment

Division 12 Furnishings/Specialties
Furnishings Sanitary Fixtures (Owner Provided)
Appliances
Acoustical Systems

Division 13 - Special Construction
Pre-Engineered Metal Buildings
Fire Sprinkler Systems

Division 14 - Elevators

Division 15 - Plumbing & Mechanical Commissioning
Plumbing
Kick off meeting to include TAB, GC and Mech sub
HVAC/Controls

Division 16 - Electrical
Power Distribution
Lighting Systems/Controls
Fire Alarm
PA System
Stage AV
Security Systems/Access Control

END OF SECTION END OF SECTION 01 31 19

SECTION 01 32 00 SCHEDULES, REPORTS AND PAYMENTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.02 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Start-up construction schedule.
   2. Contractor's construction schedule.
   3. Daily construction reports.
   4. Material location reports.
   5. Site condition reports.
   6. Special reports.

B. Related Requirements:
   1. Division 1 Section "Payment Procedures" for submitting Schedule of Values.
   2. Division 1 Section “Project Management and Coordination” for submitting and distributing meeting and conference minutes.
   3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.03 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:
   1. Submit PDF electronic file.

B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

C. Submittals Schedule: Submit electronic PDF. Arrange the following in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal Category (action or informational).
   4. Name of subcontractor.
   5. Description of Work covered.
   6. Scheduled date for Architect’s and Owner’s final release or approval.

D. Daily Construction Reports: Submit at weekly intervals.

E. Material Location Reports: Submit at weekly intervals.

F. Site Condition Reports: Submit at time of discovery of differing conditions.

G. Special Reports: Submit two copies at time of unusual event.

H. Owner’s Weekly Construction Survey Documentation/Inspection Log: Submit at weekly intervals.

1.04 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.

2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.01 SUBMITTALS SCHEDULE

A. Preparation: Arrange in chronological order by dates required by Construction Schedule.

1. Coordinate Submittals Schedule with list of subcontracts, Schedule of Values, and Contractor’s Construction Schedule.

2. Provide separate sub-schedule construction progress schedule indicating submittal daters for shop drawings, product date, samples and other similar data.

3. Submit Submittals Schedule 15 days prior to first Application for Payment.

4. Include time required for review, re-submittal, ordering, manufacturing, fabrication, and delivery when establishing dates.

a. Indicate when reviewed submittals will be required from Architect taking into consideration the quantity of days specified for Architect’s review.
b. Allow sufficient time in schedule for re-submittal of disapproved submittals.
c. Indicate decision dates for selection of finishes and colors.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart Construction Schedule. Submit within 15 days of the date established for Commencement of the Work.

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the Work as indicated in the Schedule of Values as a minimum.

2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.

3. Prepare the schedule on a sheet, or series of sheets, of staple transparency, or other reproducible media, of sufficient width to show data for the entire construction period. Maximum size allowed is 24-inches by 36-inches.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the Work.

5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontractors, submittal schedule, progress reports, payment requests and other schedules.

6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.

C. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating "pre-calculated" and "actual" costs. On the line, show dollar-volume of Work performed as of the dates used for preparation of payment requests.

2.03 DAILY REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Site Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.04 PAY REQUESTS (BY CONTRACTOR): SUBJECT TO REVISIONS AT PRE-CONSTRUCTION CONFERENCE

A. General: Except as otherwise indicated, the progress payment cycle is to be regular. Each application must be consistent with previous applications and payments. Certain applications for payment, such as the initial application, the application at substantial completion, and the final application involve additional requirements.

B. Payment Application Forms: AIA Form G702 and Contractor-prepared back-up sheets on **AIA Form G703.**

C. Initial Payment Application: The principal administrative actions and submittals which must precede or coincide with submittal of Contractor's first payment application can be summarized as follows, but not necessarily by way of limitation:

1. Listing of Subcontractors, and principal suppliers and fabricators
2. Contract Price Breakdown (Approval by Architect)
3. Progress Schedule (preliminary if not final)
4. Initial progress report, including report of pre-construction meeting

D. Final Payment Application: The administrative actions and submittals which must precede or coincide with submittal of contractor's final payment application can be summarized as follows, but not necessarily by way of limitation:

1. Completion of project closeout requirements
2. Certificates or approvals required assuring Owner's full access and use of completed work
3. Warranties (guarantees), maintenance agreements, and similar provisions of Contract Documents
4. Test/adjust/balance records, maintenance instructions, meter readings, start-up performance reports, and similar change over information germane to Owner's occupancy, use, operation and maintenance of completed work
5. Submittal of required project construction records to Architect, Subsequent review by Architect and Consultant and, if in order, transmittal to Owner
6. Change over of door locks and other Contractor's access provisions to Owner's property
7. Advice to Owner on coordination of shifting insurance coverage's, if any, including proof of extended coverage's as required
8. Proof, satisfactory to Owner, that fees and similar obligations of Contractor have been paid
9. Removal of temporary facilities, services, surplus materials, rubbish, and similar elements
10. Final cleaning of work
11. Listing of Contractor's incomplete work, recognized as exceptions to Owner's Certificate of Final Acceptance

E. Application Transmittal: Submit three executed copies of each payment application, one copy of which is completed with waivers of lien and similar attachments. Transmit each copy with a transmittal form listing those attachments, and recording appropriate information related to application in a manner acceptable to Owner. Transmit to Architect by means ensuring receipt within 24 hours.

F. Cash Flow Schedule: With the required Progress Schedule, prepare and submit for approval an Estimated Cash Flow Schedule for the work, detailing the monthly payment requirements anticipated during the course of the work for the entire scheduled construction period for each project at least 10 days prior to first request for payment.

PART 3 - EXECUTION

3.01 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Distribution: Distribute copies of approved schedule to Architect, Owner, subcontractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.

2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

B. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

C. Provide complete updated Construction Schedule to coincide with each monthly Application for Payment. Monthly Applications for Payment submitted without updated construction schedule may be held until updated construction schedule has been submitted.

END OF SECTION 01 32 00

SECTION 01 32 16 CONSTRUCTION SCHEDULE

PART 1 – GENERAL

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

1.1 SUBMITTALS

A. Schedules:

1. Preliminary Analysis: Within 10 (ten) days after receipt of Award of Contract, submit a preliminary construction schedule for review by Owner and Architect.

2. Construction Schedule: Within 14 (fourteen) days after receipt of Notice to Proceed, submit one (1) reproducible and four (4) prints of the approved construction schedule.

1.2 RELIANCE UPON SCHEDULE

A. The construction schedule as approved by the Architect will be an integral part of the contract and will establish conditions for various activities and phases of constructions.

1.3 CONSTRUCTION SCHEDULE

A. Diagram: Graphically show the order of all activities necessary to complete the work and the sequence in which each activity is to be accomplished.

B. Activities shown on the diagram shall include but not necessarily be limited to

1. Project mobilization

2. Submittals and approvals of shop drawings and samples

3. Phasing of construction

4. Procurement of equipment and critical materials

5. Fabrication and installation of special material and equipment

6. Final clean-up

7. Final inspection and testing

C. Provide and submit complete updated Construction Schedule to coincide with each monthly Application for Payment. Monthly Applications for Payment submitted without updated construction schedule may be held until updated construction schedule has been submitted.

1.4 CONSTRUCTION SCHEDULE LIMITATIONS

A. Work performed under this Contract shall be done in accordance with the following paragraphs:

1. All work may proceed immediately upon Notice to Proceed and continue uninterrupted.

2. Under the Base Proposal only, the successful Offeror will be 1) entitled to certain extensions of time and 2) subject to liquidated damages for work not completed beyond the agreed date which the Contractor shall require for Substantial Completion of the work included in this contract. Refer to Supplementary Conditions for additional requirements and liquidated damages.

3. Failure to complete and close-out project after substantial completion may result in liquidated damages. Refer to Supplementary Conditions for additional requirements and liquidated damages.

PART 2. PRODUCTS

Not Used

PART 3. EXECUTION

A. Certificate of Substantial Completion will be issued for any of the above mentioned areas of work which are complete prior to the completion of the entire project. The Owner may at his discretion approve changes recommended by the successful Offeror to the above-mentioned schedule provided that the Owner's use of newly completed areas are not disrupted.

END OF SECTION 01 32 16

SECTION 01 33 01 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to work of this section.

1.02 DESCRIPTION OF REQUIREMENTS

A. The types of submittal requirements specified in this section include shop drawings, product data, samples and miscellaneous work-related submittals. Individual submittal requirements are specified in applicable sections for each unit of work.

1.03 DEFINITIONS

A. Work-related submittals of this section are categorized for convenience as follows:

1) Shop Drawings include specially prepared technical data for this project including drawings, diagrams, performance curves, data sheets, schedules, templates, patterns, reports, calculations, instructions, measurements, and similar information not in standard printed form for general application to a range of similar projects.

2) Product Data includes standard printed information on materials, products, and systems not specifically prepared for this project other than the designation of selections from among available choices printed therein.

3) Samples include both fabricated and unfabricated physical examples of materials, products and units of work both as complete units and as smaller portions of units of work either for limited visual inspection or (where indicated) for more detailed testing and analysis.

a. Mock-ups are a special form of samples that are too large or otherwise inconvenient for handling in specified manner for transmittal of sample submittals.

4) Quality Assurance Submittals: Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of Specifications.

a. Certifications: Where other Sections of Specifications require certification that a product, material, or installation complies with specified requirements; submit a notarized certification from manufacturer certifying compliance with specified requirements.

b. Signature: an officer of manufacturer or other individual authorized to sign documents on behalf of company shall sign Certification.

5) Miscellaneous submittals related directly to the work (non-administrative) include warranties, maintenance agreements, workmanship bonds, project photographs, survey data and reports, physical work records, quality testing and certifying reports, copies of industry standards, record drawings, field measurement data, operating and maintenance materials, overrun stock, and similar information, devices and materials applicable to the work and not processed as shop drawings, product data or samples.

1.04 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's construction schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for establishment of the Contractor's construction schedule.

1. Coordinate submittal schedule with the list of subcontractors, schedule of values and the list of products as well as the Contractor's construction schedule.

2. Prepare the schedule in chronological order (per specification section numbers), include submittals required during the first 30 days of construction. Provide the following information:

a. Scheduled date for the first submittal.
b. Related section number.
c. Submittal category.
d. Name of subcontractor.
e. Description of the part of the work covered.
f. Scheduled date for resubmittal.
g. Scheduled date of the A/E's final release or approval.

B. Distribution: Following response to initial submittal, print and distribute copies to the A/E, Owner, subcontractors, and other parties required to comply with the submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revision are made, distribute to the same parties and post in same location. Delete parties from the distribution when they have completed their assigned portion of the work and are no loner involved in construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updates schedule concurrently with the report of each meeting.

1.05 GENERAL SUBMITTAL REQUIREMENTS

A. Scheduling: Where appropriate in administrative submittals (listing of products, manufacturers, suppliers and subcontractors, and in job progress schedule), show principal work-related submittals and time requirements for coordination of submittal activity with related work in each instance.

1) Listing: Prepare a separate listing, organized by related specification section number sequence, showing principal work-related submittals and their initial submittal dates as required for coordination of the work. Submit listing within 30 days of date of commencement of the work.

B. Coordination and Sequencing: Coordinate preparation and processing of submittals with performance of the work so that work will not be delayed by submittals. Coordinate and sequence different categories of submittals for same work and for interfacing units of work so that one will not be delayed for coordination of A/E's review with another.

C. Preparation of Submittals: Provide permanent marking on each submittal to identify project, date, contractor, subcontractor, and consecutively number all submittals using the specification section of the particular item as a prefix, i.e., 08 10 00-1, 08 10 00-2, 10 16 00-3, 10 16 00-4, etc. Note: Also consecutively number each submittal forwarded to the architect. On the top right hand corner of each submittal copy consecutively number each submittal with a ½" high circled number. Do not reuse numbers and do not add prefixes to previously used numbers. Show contractor's executed review and approval marking (contractor's stamp

must specifically note contractor's approval of submittal); see sample of contractor's stamp required and provide a 3" x 3" blank area on submittal for Architect/Engineer's marking. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through contractor's office will be returned by A/E without review.

1.06 CONTRACTOR'S REVIEW

A. By reviewing and stamping the submittals, the Contractor agrees and confirms the following:

The contractor has reviewed the Contract Documents and has reviewed this submittal, drawings, product data, samples and other items that relate to this submission. The contractor has verified all dimensions, quantities, field dimensions and dimensions to existing work, coordination with work to be installed and other attributes as required by the Contract Documents. These submittals are approved by the Contractor to the extent that approval is required by the Contract Documents.

The Architect is entitled to rely upon the Contractor's representation that information within this submittal is correct, accurate and complete and in conformance with the requirements of the Contract Documents.

1.07 USE OF DIGITAL DATA FOR CONSTRUCTION OR PREPARATION OF SUBMITTALS

A. GENERAL PROVISIONS

1. Upon request of the successful contractor for digital data related to this project, the contractor will be provided AIA Document C106 - 2007, Digital Data Licensing Agreement.

2. The purpose of this Agreement is to grant a license from Pfluger Architects to the Contractor or other suitable identifier for the Receiving Party, for the Contractor's use of Digital Data on the Project, and to set forth the license terms.

3. This Agreement is the entire and integrated agreement between the parties. Except as specifically set forth herein, this agreement does not create any other contractual relationship between the parties.

4. "Digital Data" is defined as information, communications, drawings, or designs created or stored for the Project in digital form. Digital Data provided will be enumerated in the attachment to the contract, E201 - 2007.

5. "Confidential Information" is defined as Digital Data that Pfluger Architects, INC., or its successors or assigns, has designated as confidential and clearly marked with an indication such as "Confidential" or "Business Proprietary."

6. "The Contractor" means [identify the contractor by name and the extent to which parties associated with the contractor are to be included].

7. "Instruments of Service" means all drawings, specifications and other documents, including Digital Data.

8. "Pfluger Architects" means Pfluger Architects, INC., its past and present partners, officers, directors, employees, agents, subsidiary and affiliated companies, attorneys, insurers, successors, and assigns.

B. LIMITED LICENSE FOR USE OF DIGITAL DATA

1. Use of Electronic Files: At the request of the successful contractor, the architect and/or consultants may provide electronic files for the convenience of the contractor to be used in construction or the preparation of shop drawings related to the project. Pfluger Architects grants the Contractor a nonexclusive, limited license to use the Digital Data solely and exclusively to perform services or construction for the Project in accordance with the conditions set forth herein. Neither Pfluger Architects, INC. nor their consultants make any representation as to the compatibility of these files with your hardware or your software beyond the specified release of the referenced software.

2. Pfluger Architects grants the Contractor a nonexclusive, limited license to use the Digital Data solely and exclusively to perform services or construction for the Project in accordance with the conditions set forth herein.

3. By accepting and utilizing any drawings or other data on any form of electronic media generated and provided by Pfluger Architects, INC. or their consultants, recipient agrees that Pfluger Architects, INC. or their consultants shall be deemed the author of the drawings and data, and shall retain all common law, statutory law and other rights, including copyrights. The electronic files submitted by Pfluger Architects, INC. or their consultants to the undersigned are submitted for an acceptance period of 30 days. Any defects the undersigned discovers during this period will be reported to Pfluger Architects, INC. By generating, providing or transmitting the Digital Data, Pfluger Architects does not grant to the Contractor an assignment of those rights, nor does Pfluger Architects convey to the Contractor any right in the software use to generate the Digital Data.

4. No other license or right shall be deemed granted or implied under this Agreement.

C. LICENSE CONDITIONS

1. The Digital Data are part of Pfluger Architects' Instruments of Service and shall not be used by the Contractor for any purpose other than as a convenience in the construction layout or preparation of shop drawings for the referenced project. Any other use or reuse of the Digital Data by the Contractor, or by others, will be at the Contractor's sole risk and without liability or legal exposure to Pfluger Architects.

2. The Contractor agrees to keep Confidential Information strictly confidential and not to disclose it to any other person except to (1) its employees; or (2) those who need to know the content of the Confidential Information in order to perform services or construction solely and exclusively for the Project.

3. Pfluger Architects does not make any representation as to the compatibility of these files with the Contactor's hardware or software beyond the specified release of the referenced software.

4. The Digital Data submitted by Pfluger Architects or its consultants to the undersigned is submitted for an acceptance period of 30 days. Any defects the Contractor discovers during this period will be reported to Pfluger Architects.

5. The Contractor agrees to make no claim and hereby waives, to the fullest extent permitted by law, any claim, cause of action, or defense of any nature against Pfluger Architects or its consultants or sub-consultants which may arise out of or in connection with the Contractor's use of the Digital Data.

6. In addition, the Contractor agrees, to the fullest extent permitted by law, to indemnify and hold Pfluger Architects and its consultants harmless from any damage, liability or cost, including reasonable attorney's fees and costs of defense, arising from any

changes made by anyone other than Pfluger Architects or its consultants, from any reuse of the Digital Data without the prior written consent of Pfluger Architects, or any other unlicensed use the Digital Data Furthermore, the Contractor, to the fullest extent permitted by law, indemnifies and holds harmless Pfluger Architects and its consultants from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting from the Contractor's use of the Digital Data.

7. The Digital Data are not contract documents. Significant differences may exist between the Digital Data and corresponding hard copy contract documents due to addenda, change orders or other revisions. In the event that a conflict arises between the signed contract documents prepared by Pfluger Architects or its consultants and the Digital Data, the signed contract documents shall govern. The Contractor is responsible for determining if any conflict exists.

8. By the Contractor's use of the Digital Data, the Contractor is not relieved of its duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, review structural shop drawings, verify field conditions and coordinate your work with that of other contractors for the project.

9. Neither Pfluger Architects nor its consultants make any representation regarding the accuracy or completeness of the Digital Data the Contractor receives.

10. Because of the potential that the information presented in the Digital Data can be modified, unintentionally or otherwise, Pfluger Architects and its consultants reserve the right to remove all indications of its ownership and/or involvement from each electronic display.

11. Under no circumstances shall transfer of the drawings or other instruments of service in Digital Data for use by the undersigned be deemed a sale by Pfluger Architects or its consultants, and neither Pfluger Architects nor its consultants make any warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall Pfluger Architects or its consultants be liable for any loss of profit or any consequential damages.

1.08 SUBMITTAL PROCEDURES

A. For purposes of this Project, the term **"OR EQUAL"** is defined as follows:

1. Any material or equipment that will fully perform the duties specified will be considered 'equal,' provided the bid submits proof that such material or equipment is of equivalent substance and function and is approved, in writing.

2. Requests for the approval of 'or equal' shall be made in writing at least five business days prior to bid opening. During the bidding period, all approvals shall be issued by the Architect/Engineer in the form of addenda at least two business days prior to the bid opening date."

3. For products specified by name and accompanied by the term 'or equal,' or 'or equivalent,' or 'or approved equal,' or 'or approved,' comply with requirements in Section 01 33 00 - Submittal Procedures' for submitting a substitution request to obtain approval for use of an unnamed product. These substitution requests must be submitted at least 5 days prior to the bid date."

B. Package each submittal appropriately for transmittal and handling. Submittals which are received from sources other than through contractor's office will be returned by A/E without review.

C. Transmittal Form: Prepare a draft of special transmittal form for project and submit to architect for acceptance. Provide places to indicate project, date, “to,” “from” names of subcontractors, suppliers, manufacturers, required references, category and type of submittal, purpose, description, distribution record (for both transmittal and submittals), and signature of transmitter.

D Provide contractor’s certification on form, ready for execution, stating that information submitted complies with requirements of contract documents.

E. By approving and submitting shop drawings, product data, samples and similar submittals, the contractor represents that the contractor has determined and verified materials, field measurements and field construction criteria related thereto and has checked and coordinated the information contained within such submittals with the requirements of the work and of the contract documents. At the time of submission, Contractor shall inform the Architect and Engineers in writing of any deviation in shop drawings or samples from the requirements of the Contract Documents.

F. The contractor is to maintain a complete copy of all submittals and project data for the owner. Turn this copy over to the owner along with other final closeout documents. Organize these submittals by division of work and present them to the owner in labeled file boxes.

1.09 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS

A. Shop Drawings: Provide newly-prepared information on sheets with graphic information at accurate scale (except as otherwise indicated), with name of preparer indicated (firm name). Show dimensions and note which are based on field measurement. Identify materials and products in the work shown. Indicate compliance with standards and special coordination requirements.

B. Product Data: Collect required data into one submittal for each unit of work or system and mark each copy to show which choices and options are applicable to project. Include manufacturer’s standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements, which have been checked, and special coordination requirements. Maintain one set of product data (for each submittal) at project site, available for reference by A/E and others.

1) Submittals: Do not submit product data or allow its use on the project until compliance with requirements of contract documents has been confirmed by contractor. Submittal is for information and record unless otherwise indicated. Submit 3 copies, plus number of copies needed for contractor, owner’s records, and distribution to others.

2) Installer’s Copy: Do not proceed with installation of materials, products, or systems until final copy of applicable product data is in possession of installer.

C. Samples: Provide units identical with final condition of proposed materials or products for the work. Include “range” samples (not less than 3 units) where unavoidable variations must be expected and describe or identify variations between units of each set. Provide full set of optional samples where A/E’s selection is required. Prepare samples to match A/E’s sample where so indicated. Include information with each sample to show generic description, source or product name and manufacturer, limitations, and compliance with standards. Samples are submitted for review and confirmation of color, pattern, texture and “kind” by A/E. Architect/Engineer will not “test” samples for compliance with other requirements, which are, therefore, the exclusive responsibility of the contractor.

D. Quality Control Set: Maintain returned final set of samples at project site in suitable condition and available for quality control comparisons by Architect/Engineer and by others.

1) Reusable Samples: Returned samples, which are intended or permitted to be incorporated in the work, are so indicated in the individual work sections and must be in undamaged condition at time of use.

E. Mock-Ups: Mock-ups and similar samples specified in individual work sections are recognized as a special type of sample. Comply with requirements for “samples” to greatest extent possible and process transmittal forms to provide a record of activity.

F. Inspection and Test Reports: Classify each as either “shop drawing” or “product data,” depending upon whether report is uniquely prepared for project or a standard publication of workmanship control testing at point of production; process accordingly.

G. Request for Interpretations or Information (RFI): In the event the Contractor/Contractor feels the Contract Documents are not clear as to the intent of the Requirements for Construction then he shall submit a RFI to the Architect on the form included at the end of this section of the specifications. Electronic versions of RFI form are available from Architect for Contractors use on this project.

H. Prior to submission of any RFI the Contractor shall:

1) Review the Contract Documents thoroughly for the specific information being requested.

2) Write a brief description of the Contractor’s recommended solution to the RFI that will result in meeting the intent of the Contract Documents.

3) RFI’s shall be sequentially numbered and dated.

4) Upon submission of this information the Architect will review and accept or give further interpretation of the documents within 7 days whenever possible. An additional 3 days should be anticipated for any RFI requiring Architects/Consultant/Owner review. Answer to RFI by Architect shall in no way give authorization to the Contractor to proceed with work that will increase contract time or construction cost.

I. Warranties: Refer to “products” section for specific general requirements on warranties, product/workmanship bonds, and maintenance agreements. In addition to copies desired for contractor’s use, furnish two (2) executed copies, except furnish two (2) additional (confirmed) copies where required for maintenance manuals.

J. Standards: Where copy submittal is indicted and except where specified integrally with “product data” submittal, submit a single copy for Architect/Engineer’s use. Where workmanship at project site and elsewhere is governed by standard, furnish additional copies to fabricators, installers, and others involved in performance of the work.

K. Close Out Submittals: Refer to individual work sections and to “close out” sections for specific requirements on submittal of close out information, materials, tools, and similar items.

1) Record Document Copies: Furnish one set.
2) Maintenance/Operating Manuals: Furnish two (2) bound copies.
3) Materials and Tools: Refer to individual work sections for required quantities of spare parts, extra, and overrun stock, maintenance tools and devices, keys, and similar physical units to be submitted.

L. General Distribution: Provide additional distribution of submittals (not included in foregoing copy submittal requirements) to subcontractors, suppliers, fabricators, installers, governing authorities, and others as necessary for proper performance of the work. Include such additional copies in transmittal to A/E where required to receive “Action” marking before final distribution. Record distributions on transmittal forms.

M. Contractors shall furnish to Owner, Manufacturer Safety Data Sheets (MSDS) for all materials installed on this project. The MSDS sheets must indicate no asbestos containing materials are included in the furnished product. Submit these MSDS sheets with each submittal and provide an additional complete set as part of the final close out documents.

1.10 ARCHITECT/ENGINEERS’ REVIEW

A. Architect/Engineer will review submittal after Contractor has reviewed and coordinated with other trades. Architect/Engineer will mark with comments as noted above. When possible, architect will return submittal within two (2) weeks of receipt of submittal and within three (3) weeks for submittals requiring engineer or other consultant review. Where submittal must be held for coordination, architect/engineer will process submittal as soon as possible after all coordination information and material is provided by contractor.

B. NOTE: ALL COLOR SELECTION SUBMITTALS WILL BE HELD UNTIL CONTRACTOR NOTIFIES A/E THAT ALL SELECTIONS FOR WORK ARE SUBMITTED. A COLOR BOARD PRESENTATION WILL THEN BE PREPARED BY ARCHITECT FOR OWNER’S REVIEW AND APPROVAL; ALLOW FIVE (5) WEEKS FOR THIS PROCESS.

C.. Marking “Reviewed. No Exceptions Noted”: Work may proceed provided it complies with contract documents.

D. Marking “Reviewed. Exceptions Noted”: Work may proceed provided it complies with notations and corrections on submittal and with contract documents.

E. Marking “Rejected. Returned for Resubmittal”: Do not proceed with work. Revise submittal in accordance with contract documents and resubmit without delay to obtain a different marking. Do not allow these submittals to be used in connection with performance of the work.

F. NOTE: The contractor shall not be relieved of responsibility for deviations from requirements of the contract documents by the architect’s approval of shop drawings, product data, samples, or similar submittals unless the contractor has specifically informed the architect, in writing and on the submittal, of such deviation at the time of submittal and the architect has given written approval to the specific deviation. The contractor shall not be relieved of responsibility for errors or omissions in shop drawings, product data, samples, or similar submittals by the architect’s approval thereof.

1.11 REPETITIVE REVIEW

A. Shop drawings, product data and samples submitted for each item, will be reviewed no more than two times at Architect's and Owner's expense. After second submittal shop drawings, product data and samples failing to comply with Contract requirements will be reviewed by Architect at Contractor's expense, based upon a flat rate of **$75.00 per hour** not to exceed $750.00 per each subsequent resubmittal. Contractor shall reimburse the Owner for additional submittal reviews. The Owner reserves the right to deduct said reimbursement from Contractor's monthly application for payment.

B. Need for resubmission of shop drawings, or delay in obtaining Architect's review of submittals, shall not entitle Contractor to an extension of Contract Time nor increase Contract Price, nor shall it become basis for a "Damage for Delay " claim.

PART 2 – PRODUCTS; PART 3 - EXECUTION
NOT USED

END OF SECTION 01 33 01

SECTION 01 35 23 OWNER SAFETY REQUIREMENTS

PART 1 - GENERAL

1.01 CONSTRUCTION SAFETY AND LOSS CONTROL PROGRAM

A. Contractor, along with the Subcontractors of all tiers, shall develop a composite Safety Program. The safety plan establishes minimum standards of performance regarding safety during the course of the work on the project. The prevention of job-related injuries and illnesses may require additional safety devices and/or procedures beyond these minimum standards. This Safety Program will include enforcement of safe practices, instructions and direction in the use of safety equipment and personal protective equipment, and other such activities as may be necessary and appropriate to maintain job safety and accident prevention. A copy of composite program (site-specific plan) shall be submitted to the Owner's Project Manager for review prior to starting work on-site by the Contractor or subcontractors) regardless of subcontractor tier.

B. Implementation and enforcement of the Safety and Loss Prevention Program for the work force of Contractor and all Subcontractors shall be responsibility of Contractor. Owner's Project Manager representatives will conduct periodic jobsite safety inspections to monitor compliance with the Safety and Loss Prevention Program.

C. If Contractor activities are not in compliance with their Safety and Loss Prevention Program, Owner's Project Manager will inform the Contractor in writing of the observed noncompliance, or safety hazards. These items must be corrected in a timely manner.

D. If the Contractor fails to correct any safety noncompliance or hazard, the Owner shall have the right but not the obligation to perform the corrective action and withhold costs associated with the corrective action from the Contractors next or final payment.

E. It is not the intent of this Contract to require the Owner, to provide services, assume responsibility or accept liability for the safety of work sites or any aspect of the work by Contractors or Subcontractors. Each Contractor shall bear sole and exclusive responsibility for safety in all phases of their work. Nothing contained herein shall relieve such responsibility.

F. The Owner's role in achieving construction safety and health objectives include overall supervisory management for site safety. This responsibility does not supersede, override or take precedence over that of construction Contractors, who are ultimately responsible for the safety and health of their employees, Subcontractors, visitors, the public and protection of property.

G. The primary functions of the Owner as it relates to construction safety and health, are to monitor Contractor compliance with the safety and health standards required by law and to administer and enforce the conditions of the contract pertaining to safety, health, and security.

H. Each Contractor and Subcontractor shall comply with all applicable safety related laws, including the following:

1. Walsh-Healy Public Contracts Act 9 (Title 41 CFR, Part 50-2-3) and the included rules and regulations contained in the Occupational Safety and Health Standards, and Established Federal Standards (Title 20 CFR, Part 1910 and CFR, Part 1926).

2. U.S. Department of Transportation Safety Requirements - Federal Highway Projects, 1968, including the requirements referred to in Appendix A therein.

3. State and local codes and regulations.

F. Safety Documentation Reporting: Contractor shall submit to the Owner's Project Manager the following reports:

1. All accident investigation reports shall be submitted no more than 24 hours after occurrence. The Contractor must maintain accurate records of personal injury and property loss, cooperate and aid in investigation of cases, and implement appropriate actions to prevent recurrence.

2. Documented safety orientation of new hire employees shall be submitted weekly along with copies of weekly toolbox meetings.

3. Weekly Contractor-held safety meeting reports shall be submitted on a weekly basis. Safety meeting reports shall be received at start of each week.

4. Weekly site safety inspection reports performed by Contractor shall be submitted weekly.

5. Safe Plans of Action (SPA) shall be completed by the contractor prior to each task and submitted weekly.

6. Task Safety Awareness (TSA) meeting documents shall be maintained by the contractor for review by the Owner's Project Manager upon request.

7. A summary of all accidents and injuries including first-aid treatment is to be submitted weekly.

8. Crane re-certification on an occurrence basis and proof of certification prior to beginning work.

9. A Job Safety Analysis (JSA) shall be performed, signed off by all crew members, job superintendent; and Contractor safety officer prior to all lifting activates using any means.

10. Crane Safety - all crane operations will require a JSA for all hoisting operations; copy of the crane lift chart marked with longest and heaviest lifts; all crew members to sign off on JSA; barricade tape around crane at all times; need crane crew to indicate on a copy of the crane's lift chart where the highest and heaviest pick is located; tail swing location, etc.

11. A summary of OSHA Safety Violations and Citations within 4 working days of the opening Inspection Conference.

12. A notice of work termination shall be submitted by the Contractor within 10 calendar days of a Subcontractor completing work under its Contract and leaving the jobsite.

13. A site-specific safety plan that must be accepted by Owner prior to

commencement of work.

14. Name and qualifications of an on site safety person who must be accepted by the Owner prior to commencement of work.

15. List of Hazardous Substances brought on site and MSDS for each item.

16. Copy of OSHA 300 log for their project.

17. Accident and injury reports within 24 hours of occurrence

1.02 SITE SAFETY DEVICES

A. Contractor and its Subcontractors performing work at project site maintain responsibility for providing all safety related equipment such as, but not limited to, testing equipment, safety valuing, chains, locks, alarms, signal, signage and personal protective equipment necessary to protect site workers and the general public.

B. Employees on walking and/or working surfaces with unprotected sides or edges six feet (6') or higher above a lower level shall be protected from falling by the use of guardrails, nets or personal fall arrest systems. This shall include, but is not limited to employees on the face of formwork, reinforcing steel or structural steel during and after erection, exterior and interior masonry work, roofing work, window installation, electrical work, mechanical work, and all other trades that require crafts/workers to work in areas where the height exceeds six feet (6') above the ground or work surface.

C. One hundred percent (100%) personal eye wear and head wear protection is required in all construction work areas and shall be worn at all times by employees of both the contractor and subcontractors (regardless of subcontractor tier). Protective eye wear shall conform and meet requirements stated in ANSI 287.1-1968.

D. Clean Up and Waste Disposal. Contractor shall perform a daily site cleanup and otherwise keep the Project Site free from accumulation of waste materials, rubbish and other debris resulting from the performance of the Work. The Contractor shall also be responsible for providing mowing / grass cutting services for areas inside of the construction areas weekly.

E. Contractor shall, in compliance with Applicable Laws, remove, transport and dispose of any Hazardous Substance transported onto the Project Site by or on behalf of Contractor or any Subcontractor, or created, used or handled as part of Contractor's or any Subcontractor's activities at the Project Site.

F. Contractor shall notify the Project Company immediately upon the discovery of the presence of any Hazardous Substance on, or the release of any Hazardous Substance on or from, the Project Site. Notwithstanding anything to the contrary set forth above, Contractor shall not be responsible for the transportation, handling, storage or removal of any Hazardous Substances which existed at, on or in the Project Site prior to commencement by Contractor of the Work.

1.03 RESPONSIBILITY

A. Each participant involved in the construction of the project is individually responsible for conducting their activities to ensure compliance with all applicable project safety and health requirements.

B. The Owner’s Project Manager is responsible to monitor generally the construction activities of the Contractors on the projects for compliance with project specific, Federal, State and local rules, regulations and codes. The Contractor's Site Safety manager is responsible for more detailed monitoring of construction activities.

1.04 CONTRACTOR SITE SAFETY MANAGER RESPONSIBILITIES

A. The Contractor's Site Safety Manager is responsible for implementing the safety and health
plan at the project level. The following specific safety and health plan guide will be followed:

1. Pre-plan work activities through the use of Safe Plans of Action (SPA) in order to identify and control any safety and health issues, which may pose a hazard to employees or others.

2. Contractors are responsible for completing Safe Plans of Action (SPA) and communicating them to employees prior to beginning each work task. This communication of safe work practices will be documented through the Task Safety Awareness meeting and form.

3. Establish and maintain a safe and healthy work environment by adhering to the guidelines and procedures issued in the latest document of the Federal, State, local code, and site-specific requirements.

4. Ensure that all Contractor employees and Subcontractors implement and abide by the safety, health, and security rules and regulations set forth by all regulatory agencies as well as those established by this plan.

5. Hold, at a minimum, weekly meetings with Subcontractors to discuss accident prevention measures, review any accident prevention measures, review any accidents which might have occurred since the last meeting, and institute any additional safety measures necessary to prevent future accidents. Meetings will include incidents, which may pose potential third party claim exposures to the District.

6. Assure that Owner's staff is knowledgeable of all Contractor Subcontractor safety and health programs. The safety manager will give special attention to those operations, which require a coordinated effort by the Contractor and Owner.

7. Maintain open and continuing communications between the Owner and the Contractors on safety and health issues.

8. Assure that the safety program general requirements apply to visitors entering the project sites. A visitor's log will be established and maintained at each project.

9. Arrange for specific job safety training for Owner's staff members using or operating special equipment or entering confined spaces and/or the use of other personal protective equipment or other analysis instruments.

10. Require that Contractor personnel complete a thorough investigation of all accidents, injuries, near hits, and take immediate corrective action to prevent

future occurrences. Reports shall be completed and submitted to the Owner's Project Manager within 24 hours after the occurrences.

11. Assure that safety is the FIRST subject of EVERY Contractor/Subcontractor meeting.

12. Review all safety inspection reports with the Subcontractors during the weekly progress meeting.

13. Prior to the construction activity by any Contractor and/or Subcontractor the Safety Manager will assure that all pre-work job safety analysis submittals have been reviewed by the Safety Manager and submitted to the Owner's Project Manager for review and assurance for compliance with the Contract Documents.

14. Verify the Contractor has no outstanding safety deficiencies that could result in the delay of payment.

15. Assign and manage additional Contractor safety personnel as warranted.

16. Conduct weekly Contractor safety records and performance audits.

17. Attend safety training sessions as required by the Owner.

1.05 OWNER'S RESPONSIBILITIES

A. Review Contractors/Subcontractors safety plan.

B. Make recommendations for administrative action when Contractors fail to correctly identify safety, health, or environmental deficiencies

C. Attend Contractor/Subcontractor toolbox safety meetings as deemed necessary

1.06 CONTRACTOR SITE SAFETY SUPERINTENDENT

A. The Contractor shall appoint a Site Safety Superintendent. This responsibility may be shared with other responsibilities who will be in charge of all phases of the Contractor's work as it relates to safety and be available at all times work Is in progress.

B. Contractor shall submit, in writing, the name and qualifications of the proposed individual to serve as Site Safety Superintendent to Owner for approval, prior to beginning work. The Site Safety Superintendent shall be qualified to serve in this capacity and shall not he changed without written notice to the Owner's Project Manager. All employee substitutions into this position must be approved by the Owner's Project Manager. The Owner shall have the right to require removal of the Site Safety Superintendent should he/she be deemed incompetent, obstructive or ineffective in carrying out the work.

B. The Site Safety Superintendent employed by the Contractor shall have full authority to act and make decisions for the Contractor in safety and loss control related matters.

C. The Contractor's Site Safety Superintendent shall monitor all work to assure that it is being performed in accordance with the requirements of the Safety Program and site specific Contractor Safety Program. This person shall be present at the work site during regular and other working hours acting in the capacity of Site Safety Superintendent.

1.07 SAFETY

A. Conduct weekly safety sessions.

B. Attendance: Mandatory for superintendent and foreman for Contractor and each Subcontractor.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01 35 23

Section 01 35 23.2
Special Owner Requirements - Badging Process
For Contractors, Sub-Contractors, Service Providers, & Vendors

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

Refer to enclosed instructions and Criminal History Record Information for necessary submission information and procedures.

1.01 SECTION INCLUDES

A. The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in Owner's Board Policy CJA and the form included herein, as required by Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117, and shall comply with all requirements of such laws and policy.

B. The General Contractor shall provide a list of all employees, suppliers, etc., that will be on the job site for more than 1 hour per day. Lists must be forwarded to the Bond Program Office 72 hours or earlier in advance of going to the site. List shall be submitted on forms contained in the Criminal History Record Information section of the specifications. Should a Contractor want to add names to their original list, they must be added on a separate list.

C. Only workers who have a completed and clear background check shall be eligible for a badge.

D. Mandatory photo identification badge with the workers name and name of the Construction Company shall be worn at all times on school district property during the construction of the project and shall be required after Substantial Completion for all new construction**.** The badges shall be provided, funded and maintained by the General Contractor. The Owner reserves the right to reject the issuing of a badge to any contractor employee as deemed appropriate to protect the Owner's interest. The Owner reserves the right to dismiss any worker not wearing proper identification, from the project site.

E. Badges will include the General Contractor, Subcontractor or Sub-subcontractor name, expiration date of the project, and photo identification of the authorized person. The expiration date will end 1 year after the date of substantial completion. Upon expiration, the contractor shall repeat the application process.

F. The Contractor shall contact the Bond Program Office with any questions during the process.

G. The general contractor and all sub contractors badges shall be orange.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.01 Refer to and follow the attached instructions.

END OF SECTION

Section 01 35 23.2

Special Owner Requirements - Badging Process

For Contractors, Sub-Contractors, Service Providers, & Vendors

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

Contact the Lamar CISD Bond Program Office for necessary submission information and procedures.

1.1 SECTION INCLUDES

A. The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in Owner's Board Policy CJA and the form included herein, as required by Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117, and shall comply with all requirements of such laws and policy.

B. The General Contractor shall provide a list of all employees, suppliers, etc., that will be on the job site for more than 1 hour per day. Lists must be forwarded to the Lamar CISD Bond Program Office 72 hours or earlier in advance of going to the site. List shall be submitted on the form template provide by the Lamar CISD Bond Program Office. Should a Contractor want to add names to their original list, they must be added on a separate list.

C. Only workers who have a completed and clear background check shall be eligible for a badge.

D. Mandatory photo identification badge with the workers name and name of the Construction Company shall be worn at all times on school district property during the construction of the project ***[required after Substantial Completion for new buildings; required at all times for renovations].*** The badges shall be provided, funded and maintained by the General Contractor. The Owner reserves the right to reject the issuing of a badge to any contractor employee as deemed appropriate to protect the Owner's interest. The Owner reserves the right to dismiss any worker not wearing proper identification, from the project site.

E. Badges will include the General Contractor, Subcontractor or Sub-subcontractor name, expiration date of the project, and photo identification of the authorized person. The expiration date will typically be 6 months after the scheduled contract substantial completion date, but not longer than one year from date of issuance. Upon expiration, the contractor shall repeat the application process.

F. The Contractor shall contact the Bond Program Office with any questions during the process.

G. Badge color for contractors and subcontractors shall be ORANGE.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 Not Used

END OF SECTION

SECTION 01 35 43 ENVIRONMENTAL PROCEDURES

PART 1 - GENERAL

1.01 ENVIRONMENTAL GOALS FOR THE PROJECT

A. Follow the International Energy Conservation Code Compliance Report located in the drawings.

B. Overall project goals: These goals are general in nature; refer to specific specification sections for more detailed requirements. Notify Owner and Architect if conflicts arise between performance of the work and environmental goals. This specification is not intended to limit alternative means of achieving these goals. Suggestions and input from the Contractor(s) for implementing these goals are encouraged.

C. Material selection and construction process goals: In support of the overall goals listed above, the following goals have been identified for the material selection and construction process. These are also general in nature and should be considered as a guideline—in the event of a conflict, any specific requirements in technical specification sections take precedence. Tradeoffs and compromises are inevitable in the pursuit of these goals, but everyone working on the project is expected to take all reasonable actions to further these goals. Notify Owner and Architect of any performance requirements that conflict unnecessarily with these goals.

1. Use resources efficiently:
   a. Select materials that use resources efficiently.
   b. Use construction practices that achieve the most efficient use of resources and materials.
   c. Recycle or reuse job-site waste.
   d. Select recycled-content materials.
   e. Select materials that can be recycled.
   f. Select materials that are manufactured or harvested regionally.

2. Avoid scarce, irreplaceable, or endangered resources:
   a. Select materials from abundant, well-managed resources.
   b. Select materials that are replaceable, renewable, or can be replenished.
   c. Select materials that minimize damage to natural habitats.

3. Use durable materials:
   . Select materials with the longest usable life.
   a. Select materials that can be reused.
   b. Select materials with the least burdensome maintenance requirements.

4. Create spaces that are healthy for occupants:
   . Select low-toxic products and materials.
   a. Select materials without toxic maintenance requirements.
   b. Specify mechanical equipment that will provide fresh air and will not trap water or pollutants.

5. Use energy efficiently:
   . Select materials with low embodied energy.
   a. Select materials that save energy during building operations.
   b. Select products and equipment that save energy during building operations.

6. Use water efficiently:
   . Use construction practices that achieve the most efficient use of water.
   a. Select water-conserving appliances and equipment.
   b. Landscape for water conservation.
   c. Capture and utilize rainwater.

7. Select materials that generate the least amount of pollution. Consider pollution and toxins generated during harvesting, mining, manufacturing, transport, installation, use, and disposal.

8. Protect/restore natural habitats.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 ENVIRONMENTAL GOALS IMPLEMENTATION

A. Contractor shall designate an on-site party (or parties) responsible for instructing workers and overseeing the Environmental Goals for the Project.

B. Distribution: The Contractor shall distribute copies of the Environmental Goals to the Job-Site Foreman, each Subcontractor, the Owner, and the Architect.

C. Meetings: Environmental Goals shall be discussed at the following meetings:

1. Pre-bid meeting

2. Pre-construction meeting

3. Regular job-site meetings

END OF SECTION 01 35 43

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 – GENERAL REQUIRMENTS

1.01 SECTION INCLUDES

A. Quality assurance - control of installation.

B. Tolerances.

C. References.

D. Mockup.

E. Manufacturers' field services and reports.

1.2 RELATED SECTIONS

A. Section 01 42 19 - Reference Standards and Definitions.

B. Section 01 33 01 - Submittal Procedures: Submission of manufacturers' instructions and certificates.

C. Section 01 45 29-Testing and Inspection Services.

D. Section 01 60 00 -- Product Requirements: Requirements for material and product quality.

E. Section 23 05 93 - Testing, Adjusting and Balancing

1.3 QUALITY ASSURANCES AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Quality Management Plan - All Bidders shall submit their firm's written quality management plan for review by the District. Bidders should describe how they intend to manage welding, materials testing, positive material identification, material handling, storage, shop inspections, site visits, reporting, installation, commissioning, etc.

C. Bidders shall submit their Quality Management organizational chart and project staffing plan for review by the District.

D. Bidders shall submit their intended schedule of in-house quality inspections for the project. This schedule should include all trades and should also be included on the Bidder's CPM schedule when It is produced.

E. Comply with manufacturers' instructions, including each step in sequence.

F. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect through Owner’s Project Manager before proceeding,

G. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

H. Perform work by persons qualified to produce workmanship of specified quality.

I. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.4 TOLERANCES

A. Monitor tolerance control of installed Products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.5 REFERENCES

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of the Architect shall not be altered from the Contract Documents by mention or interference otherwise in any reference document.

1.6 MOCK-UP

A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seats, and finishes.

C. Accepted mock-ups are representative of the quality required for the work.

D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

E. Project Mock-up Requirements: Provide an actual sample panel with the following properties:

1. Size: Minimum 6 feet wide by 8 feet tall. Size may vary according to specific project requirements. Brace and support as required to withstand structural wind loads.

2. Materials: Actual exterior finishes including, but not limited to face brick, cast stone, and plaster, actual building materials and assemblies indicating brick patterns on masonry and stud back-up as occurs with damp proofing and flashing as detailed, actual portion of aluminum storefront indicating jam, sill and head attachment and

flashing details, and where appropriate, provide mock-up of special finish details, insets and reliefs, reveals, expansion and control joints, brick ledges, brick head and sills, pipe penetrations and waterproofing materials. Provide roof edge flashing and gutter section (as applicable) in pre-finished color as selected by Architect to cap the mock-up panel.

1.7 MANUFACTURER'S FIELD SERVICES AND REPORTS

A. When specified in individual specification sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect 30 days in advance of required observations. Observer subject to approval of Architect.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturer's written instructions.

D. Submit report in duplicate within 30 days of observation to Architect for information.

PART 2 – PRODUCTS

Not Used

PART 3 – EXECUTION

Not Used

END OF SECTION 01 40 00

SECTION 01 42 00 OWNER'S REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Administrative and procedural requirements for student and staff security and safety assurance during active construction on a Lamar CISD "Occupied Campus".

1.3 DEFINITIONS

A. Lamar CISD "4S" Initiative: Clear and precise "4S" branding recognizable to all age groups identifying areas of active construction on occupied campuses.

B. 4S Safety Plan: Contractor shall develop a site and floor plan defining all construction and operational items occurring on the "Occupied Campus". Refer to Item 1.4A below for detailed requirements.

C. Contractor: Refers to the General Contractor, Job Order Contractor (JOC), Cooperative Contractor or Construction Manager at Risk.

D. Construction Worker: Any worker working for the "Contractor" or under the "Contractor's" general conditions responsibilities.

E. Occupied Campus: A campus with any staff or students present at any time.

F. Badge: Clear and precise identification worn by all "Construction Workers" on site. Refer to the "Badging" 01 35 23 specification section for detailed requirements.

G. Secure Door: A door that is locked and latched and does not open when pulled.

H. Barricade: A physical and visual barrier that is clearly marked with signage stating a warning message and directions to an alternate route.

I. Fencing: a minimum of 6'-0" high chain-link secure fence with wind screens enclosing the active construction site with no gaps greater than 6" in width. Refer to "Temporary Facilities & Controls" 01 50 00 specification section for additional detail requirements.

J. Safe Passage: A passageway clear and free of any construction hazards or obstacles.

K. Inappropriate Contact: **ANY** physical or verbal contact between a "Construction Worker" and students, staff, or community members.

L. Zero Tolerance: One time occurrence resulting in removal from all Lamar CISD campuses permanently.

1.4 SUBMITTALS

A. 4S Safety Plans: Contractor shall submit site and floor plans indicating the following items:
1. Identify secure construction area.
2. Identify construction entry and exit points.
3. Identify contractor parking.

4. Identify bus drop-off and pick-up route and location.
5. Identify parent drop-off and pick-up route and location.
6. Identify overhead power lines.
7. Identify secure laydown areas.
8. Identify dumpster locations.
9. Identify port-a-can restroom locations.
10. Identify muster location.
11. Identify evaluation location (ambulance & helicopter).
12. Identify location of signage.
13. Identify egress pathways with "Safe Passage" to a point 50'-0" from any built structure.
14. Identify and modify emergency evacuation routes.

1.5 REPORTS AND DOCUMENTS

A. Observation Reports: A report of any form generated by any project member. A report concerning students, staff, safety, or security shall be addressed immediately once received.

B. 4S Observation Reports: Bond Program Office generated observation report that requires immediate resolution.

C. All verbally relayed observations to the "Contractor" concerning students, staff, safety, or security shall be addressed immediately once received.

1.6 REQUIREMENTS

A. Lamar CISD will have a "Zero Tolerance" policy for the following items:
1. "Construction Worker" without a "Badge".
2. "Construction Worker" not ensuring that all doors are "Secure Doors".
3. "Construction Worker" alters or removes "Barricades" during construction without an alternative "4S Safety Plan" in place.
4. "Construction Worker" alters or removes "Fencing" during construction without an alternative "4S Safety Plan" in place.
5. "Construction Worker" having "Inappropriate Contact" with any student, staff, or community member.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 IMPLEMENTATION, MAINTAINCE AND TRAINING

A. The "Contractor" shall be responsible for all management, materials and equipment required to implement the "4S Safety Plan". The Owner will provide "4S" stickers and signage to be distributed and installed by the "Contractor".

B. The "Contractor" shall provide all updates to the "4S Safety Plan" when scope or site conditions change. Changes to the "4S Safety Plan" shall be provided and reviewed at least **7 days prior** to the site conditions changing.

C. The "Contractor" shall train all "Construction Workers" on the requirements listed within the Owner Requirements 01 42 00 section prior to performing any work on a Lamar CISD "Occupied Campus".

END OF SECTION 01 42 00

Guidelines for the 4S Program
Safety Plan Implementation

***Purpose**: These Guidelines outline the procedures for implementing the Lamar CISD "4S" Safety Plan during active construction on an "Occupied Campus" or a "Soon-to-Be-Occupied Campus." This implementation is in accordance with Owner's Board Policy CJA, District Emergency Operations Plan (EOP), Texas House Bill 3, Texas Education Code Section 22.0834, and Texas Administrative Code Sections 153.1101 and 153.1117, which emphasize the importance of safety in educational environments.*

***Scope**: These Guidelines apply to all personnel at Lamar Consolidated Independent School District (Lamar CISD) involved in construction projects on "Occupied Campuses" or "Soon to be Occupied Campuses," including Architects, Consultants, General Contractors, Construction Managers, Job Order Contractors (JOC), Cooperative Contractors, and all Construction Workers, in alignment with Owner's Board Policy CJA, District Emergency Operations Plan (EOP), Texas House Bill 3, Texas Education Code Section 22.0834, and Texas Administrative Code Section 153.1101 and 153.1117 for school safety.*

Procedure:

1. ***Safety Plan Development and Submission:***
   ***Note:** All Safety Plans will be developed and initiated in conjunction with the Campus and District Emergency Operations Plan (EOP). Activation of the Campus and/or District EOP shall supersede any appropriate components of this plan. LCISD Safety and Security Command*

   1.1. ***Contractor Responsibility**: The General Contractor is responsible for developing a comprehensive 4S Safety Plan (refer to Item 1.4A of Owner's Requirements Section 01 42 00), ensuring compliance with relevant statutes, laws, and policy, including Owner's Board Policy CJA, District Emergency Operations Plan (EOP), Texas House Bill 3, Texas Education Code Section 22.0834, and Texas Administrative Code Section 153.1101 and 153.1117 related to safety on school campuses.*

   1.2. ***4S Site Safety Plan Contents**: The 4S Safety Plan shall include the Site Specific & Security Plan Form, site plans, and floor plans clearly defining the following items:*

   - 1.2.1. ***Secure Construction Area**: The designated area for construction activities.*
   - 1.2.2. ***Construction Entry and Exit Points:** Designated points for entry and exit from the construction area.*
   - 1.2.3. ***Contractor Parking**: Designated parking area for construction workers.*
   - 1.2.4. ***Bus Drop-off and Pick-up Routes and Location**: Designated routes and locations for school bus drop-off and pick-up.*
   - 1.2.5. ***Parent Drop-off and Pick-up Routes and Location**: Designated routes and locations for parent drop-off and pick-up.*
   - 1.2.6. ***Overhead Power Lines**: Clear identification of overhead power lines.*
   - 1.2.7. ***Secure Laydown Areas**: Designated areas for material storage and equipment staging.*
   - 1.2.8. ***Dumpster Locations**: Designated location for dumpster.*

1.2.9. ***Port-a-Can Restroom Locations***: *Designated location for portable restroom.*
1.2.10. ***Muster Location***: *Designated location for assembly in case of emergency.*
1.2.11. ***MedEvac Location (Ambulance & Helicopter)***: *Designated location for emergency vehicle access.*
1.2.12. ***Signage Locations***: *Locations for "4S" signage.*
1.2.13. ***Egress Pathways with "Safe Passage"***: *Clearly marked egress pathways providing a minimum 50-foot distance from any built structure.*
1.2.14. ***Emergency Evacuation Routes***: *Clearly marked emergency evacuation routes.*

1.3. ***Submission Requirements:*** *The 4S Safety Plan must be submitted to the Bond Program Office Program Representative or 4S implementation Lead in writing and reviewed and approved by the LCISD Safety and Security Command and the campus principal before work starts and at least 7 days before any change in scope or site conditions that might impact the campus.*

2. *Implementation and Maintenance of the 4S Safety Plan:*

2.1. ***Contractor Responsibility***: *The General Contractor is responsible for implementing, maintaining, and posting the 4S Safety Plan in the job site trailer or field office throughout the duration of the construction project.*
2.2. ***Exterior Door Security***: *Exterior doors must always be secured unless they are physically monitored. At the end of each workday, the contractor is responsible for ensuring that all exterior doors, including mechanical room doors, are secured.*
2.3. ***Materials and Equipment***: *The Contractor shall provide and maintain all management, materials, and equipment necessary for the successful implementation of the 4S Safety Plan. Lamar CISD will provide training, "4S" stickers, and signage for distribution and installation by the Contractor.*
2.4. ***Site Safety Plan Training***: *The Contractor is responsible for training all "Construction Workers" on the approved 4S Site Safety Plan applicable to the construction site before any work is conducted on a Lamar CISD "Occupied Campus." Additionally, the Contractor must submit the training roster to the BPO's 4S Implementation lead.*
2.5. ***4S Training***: *The Contractor will schedule training with the BPO's 4S Implementation lead for all "Construction Trades" during the pre-installation meeting on the requirements of the BPO 4S Safety Program prior to performing any work on a Lamar CISD "Occupied Campus" or "Soon to be Occupied Campus."*
2.6. ***Zero Tolerance***: *Lamar CISD has a "Zero Tolerance" policy for the following:*
2.6.1. ***Construction Workers Without a Badge***: *All Construction Workers on site must always have a valid badge. "Occupied Campus" or "Soon to be Occupied Campus." (Ref para. 6.)*
2.6.2. ***Exterior Door Security***: *Propping or tampering with the locking mechanisms to render the door unsecured is strictly prohibited.*
2.6.3. ***Altering or Removing Barriers and Fencing***: *Construction workers must not alter or remove barriers or fencing without approval from the Bond Program Office. "Occupied Campus" or "Soon to be Occupied Campus." (Ref para. 1.1.3)*
2.6.4. ***Inappropriate Contact***: *Construction workers are prohibited from any inappropriate physical or verbal contact with students, staff, or community members.*
2.6.5. ***LCISD Campus Restrooms:*** *Contractors or Construction workers are prohibited from using the campus staff or students' restrooms on an active campus.*

2.6.6. ***Contractors Parking*** *(Ref para. 1.1.2.3): Construction workers may not park in STUDENT, TEACHER, STAFF, or VISITOR-designated parking lots; all construction personnel must use designated parking areas to ensure safety and avoid disruption to daily school activities.*

2.6.7. ***Theft and Unauthorized Borrowing of Lamar CISD Property****: LAMAR CISD enforces a strict zero-tolerance policy for theft and unauthorized borrowing of its property. Contractors found engaging in these activities will have their approval to work in Lamar CISD revoked immediately. Further disciplinary actions, including legal consequences, may apply.*

3. Reporting Requirements:

3.1. ***Observation Reports****: All project members and contractors are required to report issues (Ref para. 3.3.3 – 3.3.4) concerning students, staff, safety, or security immediately upon occurrence to the Bond Program Office Program Representative or 4S implementation Lead, who will then file a 4S Observation Report in eBuilder.*

3.2. ***4S Observation Reports****: The Bond Program Office will issue observation reports regarding students, staff, safety, or security. The reports will be submitted to the Contractor through eBuilder and require immediate action (within 24 hours) to address the issues raised.*

3.3. ***Verbal Reports****: All verbally relayed observations to the Contractor concerning students, staff, safety, or security shall be addressed immediately and reported to the Program Representative or Bond Program Office, who will then file a 4S Observation Report in eBuilder.*

3.4. ***Reporting through Lamar CISD QR Code****: The Lamar CISD QR Code is the designated method for reporting any incidents, observations, or concerns related to the 4S Safety Plan. This QR Code can be found on the 4S Signs or issued Lamar CISD Safety and Security information card. When submitting a report through the Lamar CISD QR Code, the following steps should be followed:*

3.4.1. ***Access the Lamar CISD QR Code*** *(Ref para. 1.1.2.12): 4S signs will be provided with a QR code on all projects and posted in visible locations throughout the construction site.*

3.4.2. ***Scan the QR Code****: Scan the QR Code using a smartphone or tablet to access the reporting form.*

3.4.3. ***Complete the Reporting Form****: Provide detailed information about the incident, observation, or concern, including date, time, location (i.e. Door #), and any relevant details.*

3.4.4. ***Submit the Report****: Once the form is completed, submit the report. The report will be automatically sent to the LCISD Safety and Security Command, Principal, and Bond Program Office for review and immediate action.*

4. Ongoing Review and Updates:

4.1. ***Regular Inspections:*** *The Bond Program Office 4S Implementation lead will conduct regular inspections of the 4S Safety Plan implementation to ensure compliance as required under Texas House Bill 3 and the guidelines set forth by the TEA.*

4.2. ***Updates*** *(Ref para. 1.1.3): The Contractor is responsible for providing all updates to the 4S Safety Plan when scope or site conditions change.*

4.3. ***Review****: Updates to the 4S Safety Plan shall be provided, reviewed, and approved by the Bond Program Office, Lamar CISD Safety and Security, and the Campus Principal at least 7 days before the site conditions change.*

5. Enforcement:

5.1. ***Owner's Rights***: *Lamar CISD reserves the right to reject a badge application if deemed necessary to protect the Owner's interests (Ref to Section 01.35.23.2).*

5.2. ***Dismissal***: *Lamar CISD reserves the right to dismiss any worker found to be violating any of the Zero Tolerance policies, as outlined in (Section 01.42.00), from the project site. Any individual who violates these policies will no longer be approved to work in Lamar CISD, and their badge will be turned into the BPO.*

6. Contractor Badge Requirements:

6.1. ***Contractor Badge Process***: *The Contractor shall comply with all requirements of the "Badging" 01.35.23 specification section, outlined in the attached document:*

6.1.1. ***Criminal Background Check***: *The Contractor/Subcontractor shall certify the Criminal Background Check, as stated in Owner's Board Policy CJA, and ensure compliance with Texas Education Code Section 22.0834 and Texas Administrative Code Section 153.1101 and 153.1117, which mandate criminal history checks for personnel working in schools as part of student safety initiatives supported by House Bill 3.*

6.1.2. ***Employee List***: *The General Contractor shall provide a list of all employees, suppliers, etc., on the job site for more than one hour per day. Lists must be forwarded to the Bond Program Office 1 week or earlier before going to the site. For information on the submission procedure, please contact the Lamar CISD Bond Program Office Senior Program Administrator (832.223.0550).*

6.1.3. ***Badge Eligibility***: *Only workers who have a completed and clear background check shall be eligible for a badge.*

6.1.4. ***Badge Requirement***: *Mandatory photo identification badges with the worker's name and the name of the Construction Company shall always be worn on school district property during the construction of a project. Badges are required after Substantial Completion for new buildings and are always required for renovations. The badges shall be provided, funded, and maintained by the General Contractor. The badge color for contractors and subcontractors shall be ORANGE.*

6.1.5. ***Raptor Badge***: *All construction workers awaiting their approved badges must report to the front office upon arrival, present valid identification for registration through our Raptor system, and wear the designated visitor pass at all times while on the LAMAR CISD-occupied campus.*

6.1.6. ***Badge Issuance***: *The Owner reserves the right to reject the issuing of a badge to any contractor employee as deemed appropriate to protect the Owner's interest. The Owner reserves the right to dismiss any worker who does not wear proper identification from the project site.*

6.1.7. ***Badge Expiration***: *Badges will include the General Contractor, Subcontractor, or Sub-subcontractor name, expiration date of the project, and photo identification of the authorized person. The expiration date will typically be 6 months after the scheduled contract substantial completion date but not longer than one year from the date of issuance. Upon expiration*

Note: *This document is a living document and will be updated regularly to reflect new information, changes in policy, or evolving practices. Please ensure you refer to the latest version, which will be made available as changes occur.*

SECTION 01 42 19 REFERENCE STANDARDS AND DEFINITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 DEFINITIONS

A. General: Basic Contract definitions are included in the General Conditions.

B. **Indicated**: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.

C. **Directed**: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect," "requested by the Architect," and similar phrases.

D. **Approve**: The term "approved," where used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in General and Supplementary Conditions.

E. **Regulation**: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

F. **Furnish**: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."

G. **Install**: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."

H. **Provide**: The term "provide" means "to furnish and install, complete and ready for the intended use."

I. **Installer**: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. The term **"experienced"** when used with the term **"Installer"** means having a minimum of 5 previous Projects similar in size and scope to this Project, being familiar with the precautions required, and having complied with requirements of the authority having jurisdiction.

J. **Assignment of Specialists:** Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and

assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.

1. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.

K. **Testing Laboratories**: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 33-Division format and MASTERFORMAT numbering system.

B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

C. **Abbreviated Language**: Language used in Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the full context of the Contract Documents so indicates.

D. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

1.04 INDUSTRY STANDARDS

A. **Applicability of Standards**: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference.

B. **Publication Dates**: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.

C. **Conflicting Requirements**: Where compliance with two or more standards is specified, and the standards establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to the Architect for a decision before proceeding.

D. **Minimum Quantity or Quality Levels**: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

E. **Copies of Standards**: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.

F. **Abbreviations and Names**: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

1.05 GOVERNING REGULATIONS/AUTHORITIES

A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents; that information may or may not be of significance to the Contractor. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

1.06 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

1.07 SCHEDULE OF REFERENCES

AA	Aluminum Association 1400 Crystal Drive, #430 Arlington, VA 22202	www.aluminum.org (703) 358-2960
AABC	Associated Air Balance Council 1220 19th St., NW, Suite 410 Washington, DC 20036	www.aabc.com (202) 737-0202
AAMA	American Architectural Manufacturers Assoc. 1900 E. Golf Rd., #1250 Schamburg, IL 60173	www.aamanet.org (847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol St., Suite 249 Washington, DC 20001	www.transportation.org (202) 624-5800
AATCC	American Association of Textile Chemists and Colorists P.O. Box 12215 One Davis Dr. Research Triangle Park, NC 27709-2215	www.aatcc.org (919) 549-8141
ABMA	American Bearing Manufacturers Assoc. 330 N. Wabash Ave., Ste. 2000 Chicago, IL 60611	www.americanbearing.org (202) 367-1155
ABMA	American Boiler Manufacturers Association 8221 Old Courthouse Rd. #380	www.abma.com

	Vienna, VA 22182	(703) 356-7172
ACI	American Concrete Institute 38800 Country Club Dr. Farmington Hills, MI 48331-3439	www.concrete.org (248) 848-3700
ACIL	American Council of Independent Laboratories 1875 I Street, NW, #500 Washington, DC 20006	www.acil.org (202) 887-5872
ACPA	American Concrete Pipe Association 8445 Freeport Parkway, #350 Irving, TX 75063	www.concrete-pipe.org (972) 506-7216
ADC	Air Duct Council 1901 N. Roselle Road, #800 Schamburg, IL 60195	www.flexibleduct.org (847) 706-6750
AF&PA	American Forest & Paper Association 1101 K Street, #700 Washington, DC 20005	www.afandpa.org (202) 463-2700
AGA	American Gas Assoc. 400 North Capitol Street NW., Suite 450 Washington, DC 20001	www.aga.org (202) 824-7000
AGC	Associated General Contractors of America 2300 Wilson Blvd., #300 Arlington, VA 22201	www.agc.org (703) 548-3118
AHAM	Association of Home Appliance Manufacturers 1111 19th Street, NW, #402 Washington, DC 20036	www.aham.org (202) 872-5955
AHRI	Air-Conditioning, Heating & Refrigeration Institute 2311 Wilson Blvd., Suite 400 Arlington, VA 22201	www.ahrinet.org (703) 524-8800
AI	Asphalt Institute 2696 Research Park Dr. Lexington, KY 40511-8480	www.asphaltinstitute.org (866) 540-9577 (859) 288-4960
AIA	The American Institute of Architects 1735 New York Ave., NW Washington, DC 20006	www.aia.org (202) 626-7300
AIA	American Insurance Assoc. 555 12th Street, NW, #550 Washington, DC 20004	www.aiadc.org (202) 828-7100
AIHA	American Industrial Hygiene Assoc. 3143 Fairview Park Dr., #777 Falls Church, VA 22042	www.aiha.org (703) 849-8888
AISC	American Institute of Steel Construction 130 E. Randolph, Suite 2000 Chicago, IL 60601-2001	www.aisc.org (800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute 25 Massachusetts Ave, NW, #800 Washington, DC 20001	www.steel.org (202) 452-7100
AITC	American Institute of Timber Construction 7012 S. Revere Pkwy, Suite 140 Englewood, CO 80112	www.aitc-glulam.org (303) 792-9559
ALI	Associated Laboratories, Inc. 1323 Wall Street	www.assoc-labs.com

	Dallas, TX 75215	(214) 565-0593
ALSC	American Lumber Standards Committee 7470 New Technology Way, Suite F Frederick, MD 21703	www.alsc.org (301) 972-1700
AMCA	Air Movement and Control Assoc. (AMCA) 30 W. University Dr. Arlington Heights, IL 60004-1893	www.amca.org (847) 394-0150
ANLA	American Nursery & Landscape Association 1200 G St. NW, #800 Washington, DC 20005	www.anla.org (202) 789-2900
ANSI	American National Standards Institute 1899 L Street NW, #1100 Washington, DC 20036	www.ansi.org (202) 293-8020
AOAC	AOAC International (Assoc. Of Analytical Chemists) 2275 Research Blvd. #300 Rockville, MD 20850-3250	www.aoac.org (800) 379-2622
APA	APA The Engineered Wood Association (Formerly American Plywood Assoc.) 7011 S. 19th St. Tacoma, WA 98466-5333	www.apawood.org (253) 565-6600
API	American Petroleum Institute 1220 L St., NW Washington, DC 20005	www.api.org (202) 682-8000
ARMA	Asphalt Roofing Manufacturers Assoc. Public information Department 750 National Press Bldg 529 14th St, NW Washington, DC 20045	www.asphaltroofing.org (202) 591-2450
ASA	Acoustical Society of America Suite 300 1305 Walt Whitman Road Melville, NY 11747 – 4300	www.acousticalsociety.org (516) 576-2360
ASC	Adhesive and Sealant Council 7101 Wisconsin Ave., #990 Bethesda, Maryland 20814	www.ascouncil.org (301) 986-9700
ASCA	Architectural Spray Coaters, Association 895 Doncaster Drive West Deptford, NJ 08066	www.ascassoc.com (609) 848-5120
ASCE	American Society of Civil Engineers 1801 Alexander Bell Dr. Reston, VA 20191	www.asce.org (800) 548-2723
ASHE	American Society for Healthcare Engineering 155 N. Wacker Dr. #400 Chicago, IL 60606	www.ashe.org (312) 422-3800 (800) AHA-2626
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers 1791 Tullie Circle, NE Atlanta, GA 30329-2305	www.ashrae.org (404) 636-8400
ASME	American Society of Mechanical Engineers International Two Park Ave New York, NY 10016	www.asme.org (212) 591-7722 (800) 843-2763

ASPE	American Society of Plumbing Engineers 6400 Shafer Ct., #350 Rosemont, IL 60018	www.aspe.org (847) 296-0002
ASSE	American Society of Sanitary Engineering 18927 Hickory Creek Dr., #220 Mokena, IL 60448	www.asse-plumbing.org (708) 995-3019
ASTM	American Society for Testing and Materials 100 Barr Harbor Dr. West Conshohocken, PA 19428	www.astm.org (610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions 1200 G St., NW, Suite 500 Washington, DC 20005	www.atis.org (202) 628-6380
AWI	Architectural Woodwork Institute 46179 Westlake Dr., #120 Potomac Falls, VA 20165	www.awinet.org (800) 449-8811 (571) 323-3636
AWPA	American Wood Products Association 100 Chase Park South, Suite 116 Birmingham, AL 35244-1851	www.awpa.com (205) 733-4077
AWPA	American Wire Producers Association P.O. Box 151387 Alexandria, VA 22315	www.awpa.org (703) 299-4434
AWS	American Welding Society 8669 NW 36 Street #130 Miami, FL 33166	www.aws.org (800) 443-9353 (305) 443-9353
AWWA	American Water Works Assoc. 6666 W. Quincy Ave. Denver, CO 80235	www.awwa.org (800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Assoc. 355 Lexington Ave., 15th Floor New York, NY 10017-6603	www.buildershardware.com (212) 297-2122
BIA	Brick Industry Association 12007 Sunrise Valley Dr., Suite 430 Reston, VA 20191	www.gobrick.com (703) 620-0010
BIFMA	The Business and Institutional Furniture Manufacturer's Association International 678 Front Ave. NW, #150 Grand Rapids, MI 49504-5368	www.bifma.org (616) 285-3963
CAGI	Compressed Air and Gas Institute 1300 Sumner Ave. Cleveland, OH 44115-2851	www.cagi.org (216) 241-7333
CADS	Color Association of the United States 33 Whitehall St., Suite M3 New York, NY 10004	www.colorassociation.com (212) 947-7774
CCC	Carpet Cushion Council 5103 Brandywine Drive Eagleville, PA 19403	www.carpetcushion.org (484) 687-5170
CDA	Copper Development Association Inc. 7918 Jones Branch Dr., Suite 300 McLean, VA 22102	www.copper.org (212) 251-7200 (800) 232-3282
CGA	Compressed Gas Assoc.	www.cganet.com

	14501 George Carter Way, #103 Chantilly, VA 20151	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association 133 S. Keowee St. Dayton, OH 45402	www.cellulose.org (888) 881-2462
CISCA	Ceiling and Interior Systems Construction Assoc. 1010 Jorie Blvd, Suite 30 Oak Brook, IL 60523	www.cisca.org (630) 584-1919
CISPI	Cast Iron Soil Pipe Institute 2401 Fieldcrest Dr. Mundelein, IL 60060	www.cispi.org (224) 864-2910
CLFMI	Chain Link Fence Manufacturers Institute 10015 Old Columbia Rd, #B215 Columbia, MD 21046	www.chainlinkinfo.org (301) 596-2583
CPA	Composite Panel Association 19465 Deerfield Ave., #306 Leesburg, VA 20176	www.compositepanel.org (703) 724-1128
CPPA	Plastic Pipe Institute 105 Decker Ct. #825 Irving, TX 75062	www.plasticpipe.org (469) 499-1044
CRI	Carpet and Rug Institute 100 S Hamilton St. P.O. Box 2048 Dalton, GA 30722-2048	www.carpet-rug.com (800) 882-8846 (706) 278-3176
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Rd. Schaumburg, IL 60173-4758	www.crsi.org (847) 517-1200
CSI	Construction Specifications Institute 110 South Union St., #100 Alexandria, VA 22314	www.csinet.org (800) 689-2900
CTI	Cooling Technology Institute 3845 Cypress Creek Parkway P.O. Box 681807 Houston, TX 77068	www.cti.org (281) 583-4087
CTIOA	Ceramic Tile Institute of America 12061 West Jefferson Blvd. Culver City, CA 90230 – 6219	www.ctioa.org (310) 547-7800
DHI	Door and Hardware Institute 14150 Newbrook Dr., Suite 200 Chantilly, VA 20151-2274	www.dhi.org (703) 222-2010
DIPRA	Ductile Iron Pipe Research Assoc. P.O. Box 190306 Birmingham, AL 35219	www.dipra.com (205) 402-8700
ECIA	Electronic Components Industry Association 2214 Rock Hill Road, #265 Herndon, VA 20170	www.ecianow.org (571) 323-0294
EIMA	EIFS Industry Manufacturers Assoc. 513 West Broad Street, #210 Falls Church, VA 22046-3257	www.eima.com (800) 294-3462 (770) 968-7945
EJMA	Expansion Joint Manufacturers Assoc. 25 N. Broadway Tarrytown, NY 10591	www.ejma.org (914) 332-0040

FCI	Fluid Controls Institute 1300 Sumner Ave. Cleveland, OH 44115-2851	www.fluidcontrolsinstitute.org (216) 241-7333
FCICA	Floor Covering Installation Contractors Assoc. 7439 Millwood Dr. West Bloomfield, MI 48322	www.fcica.com (248) 661-5015
FGMA	Flat Glass Marketing Assoc. (Now GANA)	
FM	Factory Mutual (See FMGlobal) 1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, MA 02062	 (617) 762-4300
FMG	FM Global (Formerly: FM – Factory Mutual System) 1 Cowboys Way, Suite 600 Frisco, TX 75034	www.fmglobal.com (401) 275-3000 (972) 377-4808
GA	Gypsum Association 962 Wayne Ave., Suite 620 Silver Spring, MD 20910	www.gypsum.org (301) 277-8686
GANA/NGA	Glass Association of North America (National Glass Association) 1945 Old Gallows Rd., Suite 750 Vienna, VA 22182	www.glasswebsite.com (703) 442-4890
GSI	Geosynthetic Institute 475 Kedron Ave. Folsom, PA 19033	www.geosynthetic-institute.org (610) 522-8440
HEI	Heat Exchange Institute 1300 Sumner Ave. Cleveland, OH 44115-2851	www.heatexchange.org (216) 241-7333
HI	Hydraulic Institute 6 Campus Drive, First Floor North Parsippany, NJ 08807	www.pumps.org (888) 786-7744 (973) 267-9700
HI (AHRI)	Hydronics Institute (See AHRI)	
HMA	Hardwood Manufacturers Assoc. 665 Rodi Road, Suite 305 Pittsburgh, PA 15235	www.hmamembers.org (412) 244-0440
HPVA	Hardwood Plywood and Veneer Assoc. (Now Decorative Hardwoods Association) 42777 Trade West Dr. Sterling , VA 20166	www.decorativehardwoods.org (703) 435-2900
HPW	H.P. White Laboratory, Inc. 3114 Scarboro Road Street, MD 21154	www.hpwhite.com (410) 838-6550
ICEA	Insulated Cable Engineers Association, P.O. Box 493 Miamitown, OH 45041-9998	www.icea.net (508) 394-4424
ICRI	International Concrete Repair Institute (The) 1000 Westgate Drive, Suite 252 St. Paul, MN 55114	www.icri.org (651) 366-6095
IEC	International Electrotechnical Commission	www.iec.ch

	North America 446 Main St., 16th Floor Worcester, MA 01608	(508) 755-5663
IEEE	Institute of Electrical and Electronic Engineers 3 Park Ave, 17th Floor New York, NY 10016	www.ieee.org (212) 419-7900
IESNA	Illuminating Engineering Society of North America 120 Wall St., Floor 17 New York, NY 10005-4001	www.ies.org (212) 248-5000
IGCC	Insulating Glass Certification Council c/o ETL Testing Laboratories, Inc. P.O. Box 730 Sackets Harbor, NY 13685	www.igcc.org (315) 646-2234
ILI	Indiana Limestone Institute of America 611 N. Walnut Grove Ave., Suite S-217 Bloomington, IN 47405	www.iliai.com (812) 275-4426
IMSA	International Municipal Signal Assoc. 597 Haverty Court, #100 Rockledge, FL 32955	www.imsasafety.org (321) 392-0500
ISA	International Society of Automation P.O. Box 12277 67 T.W. Alexander Dr. Research Triangle Park, NC 27709	www.isa.org (919) 549-8411
KCMA	Kitchen Cabinet Manufacturers Assoc. 1899 Preston White Dr. Reston, VA 22091-4326	www.kcma.org (703) 264-1690
LGSI	Light Gage Structural Institute P.O. Box 866301 Plano, TX 75086-6301	www.loseke.com (972) 370-0967
LPI	Lightning Protection Institute P.O. Box 99 Maryville, MO 64468	www.lightning.org (847) 577-7200 (800) 488-6864
MBMA	Metal Building Manufacturer's Assoc. 1300 Sumner Ave. Cleveland, OH 44115-2851	www.mbma.com (216) 241-7333
MCA	Metal Construction Association 8735 W. Higgins Rd., Suite 300 Chicago, IL 60631	www.metalconstruction.org (847) 375-4718
MCAA	Mechanical Contractors Association of America 1385 Piccard Dr. Rockville, MD 20850-4329	www.mcaa.org (301) 869-5800
MFMA	Maple Flooring Manufacturers Assoc. One Parkview Plaza, Suite 800 Oakbrook Terrace, IL 60181	www.maplefloor.org (888) 480-9138
MFMA	Metal Framing Manufacturers Association 330 N. Wabash Ave. Chicago, IL. 60611-4267	www.metalframingmfg.org (312) 644.6610
MGPHO	Medical Gas Professional Healthcare Organization, Inc 16339 Kranker Drive Stilwell, KS 66085	www.mgpho.org (913) 269-6699

MHI	Material Handling Industry of America 8720 Red Oak Blvd, Ste 201 Charlotte, NC 28217-3996	www.mhia.org (704) 676-1190
MIA	Marble Institute of America 380 E Lorain St. Oberlin, OH 44074	www.marble-institute.com (614) 228-6194
MIA	Masonry Institute of America 1315 Storm Parkway Torrance, CA 90501	www.masonryinstitute.org (310) 257-9000
ML/SFIA	Metal Lath/Steel Framing Industry Association 513 W. Broad St. Suite 210 Falls Church, VA 22046	www.sfiamemberclicks.net (703) 538-1613
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park St., NE Vienna, VA 22180-4602	www.mss-hq.com (703) 281-6613
TCIA	Tree Care Industry Association (formerly National Arborist Assoc.) 136 Harvey Rd., Suite 101 Londonderry, NH 03053	www.tcia.org (800) 733-2622
NAAMM	National Association of Architectural Metal Manufacturers 800 Roosevelt Rd., Bldg.C, Suite 312 Glen Ellyn, IL 60137	www.naamm.org (630) 942-6501
NAIMA	North American Insulation Manufacturers Assoc. 11 Canal Center Plaza, Suite 103 Alexandria, VA 22314	www.naima.org (703) 684-0084
NAMI	National Accreditaion and Management Institute, Inc. 4794 George Washington Memorial Hwy Hayes, VA 23072	www.namicertification.com (804) 684-5124
NAPA	National Asphalt Pavement Assoc. NAPA Building 5100 Forbes Blvd. Lanham, MD 20706-4407	www.asphaltpavement.org (888) HOT MIXX (468-6499)
NBGQA	National Building Granite Quarries Assoc., Inc. c/o Rock of Ages 369 N. State St. Concord, NH 03301	www.nbgqa.com
NBH	National Builders Hardware Assoc. 1019 SE 10th Ave. Portland, OR 97214	www.nbhco.com (503) 233-5381
NCMA	National Concrete Masonry Association. 13750 Sunrise Valley Dr. Herndon, VA 22171-3499	www.ncma.org (703) 713-1900
NCPI	National Clay Pipe Institute N6369 US Hwy 12, Suite A Elkhorn, WI 53121	www.ncpi.org (262) 742-2904
NCRPM	National Council on Radiation Protection and Measurements 7910 Woodmont Ave., Suite 400 Bethesda, MD 20814 - 3095	www.ncrponline.org (301) 657-2652
NCSPA	National Corrugated Steel Pipe	www.ncspa.org

	Association 14070 Proton Rd, Suite 100 LB 9 Dallas, Texas 75244	 (972) 850-1907
NCTA	National Cable Television Association 25 Massachusetts Ave. NW #100 Washington, DC 20001	www.ncta.com (202) 222-2300
NEBB	National Environmental Balancing Bureau 8575 Grovemont Circle Gaithersburg, MD 20877	www.nebb.org (301) 977-3698
NEC	National Electrical Code (Available from NFPA)	
NECA	National Electrical Contractors Assoc. 3 Bethesda Metro Center, Suite 1100 Bethesda, MD 20814-5372	www.necanet.org (301) 657-3110
NEII	National Elevator Industry, Inc. 5003 Westfield Blvd. P.O. Box 231137 Centreville, VA 20120	www.neii.org (703) 266-3100
NELMA	Northeastern Lumber Manufacturers Assoc. 272 Tuttle Rd. P.O. Box 87A Cumberland Center, ME 04021	www.nelma.org (207) 829-6901
NEMA	National Electrical Manufacturers Assoc. 1300 N. 17th St., Suite 900 Arlington, VA 22209	www.nema.org (703) 841-3200
NETA	International Electrical Testing (Netaworld) 3050 Old Centre Ave., Suite 101 Portage, MI 49024	www.netaworld.org (269) 488-6382
NFPA	National Fire Protection Assoc. One Batterymarch Park P.O. Box 9101 Quincy, MA 02269-9101	www.nfpa.org (617) 770-3000 (800) 344-3555
NFRC	National Fenestration Rating Council 6305 Ivy Lane, Suite 140 Greenbelt, MD 20770	www.nfrc.org (301) 589-1776
NGA	National Glass Association 1945 Old Gallows Rd., Suite 750 Vienna, VA 22182	www.glass.org (703) 442-4890
NHLA	National Hardwood Lumber Assoc. 6830 Raleigh Lagrange Rd. P.O. Box 34518 Memphis, TN 38134-0518	www.nhla.com (901) 377-1818
NOFMA	National Wood Flooring Assoc. 111 Chesterfield Industrial Boulevard Chesterfield, MO 63005	www.nwfa.org (800) 422-4556
NPA	National Particleboard Assoc. (See CPA – Composite Panel Association)	
ACA (NPCA)	American Coatings Association (National Paint and Coatings Assoc.) 901 New York Ave, NW, Suite 300 West Washington, DC 20001	www.paint.org (202) 462-6272

NRCA	National Roofing Contractors Assoc. O'Hare International Center 10255 W. Higgins Rd., Suite 600 Rosemont, IL 60018-5607	www.nrca.net (800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association 900 Spring St. Silver Spring, MD 20910	www.nrmca.org (240) 485-1153
NSF	NSF International (Formerly National Sanitation Foundation) 3475 Plymouth Rd. P.O. Box 130140 Ann Arbor, MI 48113-0140	www.nsf.org (800) 673-6275 (734) 769-8010
NSSEA	National School Supply and Equipment Assoc. 8300 Colesville Rd., Stc. 250 Silver Spring, MD 20910	www.nssea.org (301) 495-0240
NTMA	National Terrazzo and Mosaic Assoc. 209 N. Crockett St., Ste. #2 Fredericksburg, TX 78624	www.ntma.com (800) 323 9736
NWMA	National Woodwork Manufacturers Assoc. (Now NWWDA)	
PATMI	Power Actuated Tool Manufacturers' Institute, Inc. 320 North Fifth St. St. Charles, MO 63301	www.patmi.org (636) 578-6610
PCA	Portland Cement Assoc. 5420 Old Orchard Rd. Skokie, IL 60077-1083	www.cement.org (847) 966-6200
PCI	Precast/Prestressed Concrete Institute 200 West Adams St., Ste 2100 Chicago, IL 60606	www.pci.org (312) 786-0300
PDCA	Painting and Decorating Contractors of America 2316 Millpark Dr. Maryland Heights, MO 63043	www.pdca.com (800) 332-7322
PDI	Plumbing and Drainage Institute 800 Turnpike St., Suite 300 North Andover, MA 01845	www.pdionline.org (800) 589-8956 (978) 557-0720
PEI	Porcelain Enamel Institute P.O. Box 920220 Norcross, Georgia 30010	www.porcelainenamel.com (770) 676-9366
PGI/EPI	PVC Geomembrane Institute c/o Environmental Protection, Inc. 1567 W. South Airport Rd. Traverse City, MI 49686	 www.geomembrane.com (231) 943-2266
PIMA	Polyisocyanurate Insulation Manufacturers Association 1220 North Fillmore St. Arlington, Virginia 22201	www.polyiso.org (703) 684-1136
RFCI	Resilient Floor Covering Institute 115 Broad St., Suite 201 LaGrange, GA 30240	www.rfci.com
RIS	Redwood Inspection Service 818 Grayson Rd., Suite 201	www.redwoodinspection.com

	Pleasant Hill, CA 94523	(925) 935-1499
RMA	Rubber Manufacturers Assoc. c/o US Tire Manufacturers Association 1400 K St., NW Washington, DC 20005	www.ustires.org (202) 682-4800
SAE	SAE International (Society of Automotive Engineers) 400 Commonwealth Dr. Warrendale, PA 15096-0001	www.sae.org (724) 776-4841
SDI	Steel Deck Institute 2661 Clearview Rd. #3 Allison, Park, PA 15101	www.sdi.org (412) 487-3325
SDI	Steel Door Institute 30200 Detroit Rd. Westlake, OH 44145-1967	www.steeldoor.org (440) 889-0010
SEFA	Scientific Equipment and Furniture Assoc. 65 Hilton Ave. Garden City, NY 11503	www.sefalabs.com (877) 294-5424
SGCC	Safety Glazing Certification Council 205 West Main St. P.O. Box 730 Sackets Harbor, NY 13685	www.sgcc.org (315) 646-2234
SHLMA	Southern Hardwood Lumber Manufacturers	(Now HMA)
SIGMA	Sealed Insulating Glass Manufacturers Assoc. 401 N. Michigan Ave. Chicago, IL 60611	www.sigmaonline.org/sigma (312) 644-6610
SJI	Steel Joist Institute 234 W. Cheves St. Florence, SC 29501	www.steeljoist.org (843) 407-4091
SMACNA	Sheet Metal and Air Conditioning Contractors' National Assoc. 4201 Lafayette Center Dr. Chantilly, VA 22151-1219	www.smacna.org (703) 803-2980
SPFA	Spray Polyurethane Foam Alliance 3927 Old Lee Hwy. #101B Fairfax, VA 22030	www.sprayfoam.org (800) 523-6154
SPI	The Society of the Plastics Industry Plastics Industry Association 1425 K St. NW, Suite 500 Washington, DC 20005	www.plasticsindustry.org (202) 974-5200
SPIB	Southern Pine Inspection Bureau P.O. Box 10915 Pensacola, FL 32524-0915	www.spib.org (850) 434-2611
SPRI	Single Ply Roofing Industry (Formerly Single Ply Roofing Institute) 465 Waverley Oaks Rd., Suite 421 Waltham, MA 02452	www.spri.org (781) 647-7026
SSINA	Specialty Steel Industry of North America 3050 K St., NW Washington, DC 20007	www.ssina.com (800) 982-0355 (202) 342-8630
SSMA	Steel Stud Manufacturers Association 35 E. Wacker Dr., Suite 850	www.ssma.com (312) 224-2570

	Chicago, IL 60601-2106	
SSPC	The Society for Protective Coatings 800 Trumbull Dr. Pittsburg, PA 15205	www.sspc.org (877) 281-7772
SSPC	Steel Structures Painting Council (The Society for Protective Coatings) 800 Trumbull Dr. Pittsburg, PA 15205	 (877) 281-7772
SSPMA	Sump and Sewage Pump Manufacturers Assoc. P.O. Box 44071 Indianapolis, IN 46244	www.ssprna.org (317) 636-0278
STI/SPFA	Steel Tank Institute 944 Donata Ct. Lake Zurich, IL 60047	www.steeltank.com (847) 438-8265
SWI	Steel Window Institute 1300 Sumner Ave. Cleveland, OH 44115-2851	www.steelwindows.com (216) 241-7333
SWPA	Submersible Wastewater Pump Assoc. 1866 Sheridan Road, Suite 201 Highland Park, IL 60035-2545	www.swpa.org (847) 681-1868
TCNA	Tile Council of North America 100 Clemson Research Blvd. Anderson, SC 29625	www.tcnatile.com (864) 646-8453
TPI	Truss Plate Institute 218 N Lee St. Ste 312 Alexandria, VA 22314	www.tpinst.org (703) 683-1010
TPI	Turfgrass Producers International 444 E. Roosevelt Rd. #346 Lombard, IL 60148	www.turfgrasssod.org (847) 649-5555 (800) 405-8873
UFAC	Upholstered Furniture Action Council P.O. Box 2436 High Point, NC 27261	www.ufac.org (336) 885-5065
UL	Underwriters Laboratories 333 Pfingsten Rd. Northbrook, IL 60062-2096	www.ul.com (800) 704-4050 (847) 272-8800
UNI	Uni-Bel PVC Pipe Assoc. 2711 LBJ Freeway, Suite 1000 Dallas, TX 75234	www.uni-bell.org (972) 243-3902
USITT	United States Institute for Theatre Technology, Inc. 315 S. Crouse Ave., Ste. 200 Syracuse, NY	www.culturenet.ca/usitt (315) 463-6463
USP	U.S. Pharmacopeia (Formerly U.S. Pharmacopoeia] Convention) 12601 Twinbrook Pkwy Rockville, MD 20852	www.usp.org (800) 227-8772
WA	Wallcoverings Assoc. 330 N. Wabash Ave., Suite 2000 Chicago, IL 60611-4267	www.wallcoverings.org (312) 321-5166
WCLIB	West Coast Lumber Inspection Bureau 6980 SW VARNS Tigard, OR 97223	www.wclib.org (800) 283-1486 (503) 639-0651

WCMA	Wood Components Manufacturer's Association P.O. Box 662 Lindstrom, MN 55045	www.wcma.com (651) 332-6332
WCMA	Window Covering Manufacturers Assoc. 355 Lexington Ave., 15th Floor New York, NY 10017	www.wcmanet.org (800) 506-4653 (212) 297-2122
WIC	Woodwork Institute of California 3188 Industrial Blvd. P.O. Box 980247 West Sacramento, CA 95798-0247	www.wicnet.org (916) 372-9943
WMMPA	Wood Molding & Millwork Producers Assoc. 507 1st St. Woodland, CA 95695	www.wmmpa.com (800) 822-8772 (530) 661-9591
WRI	Wire Reinforcement Institute www.wirereinforcementinstitute.org 942 Main Street, Suite 300 Hartford, CT 06103	 (800) 552-4974
WSC	Water Systems Council www.watersystemscouncil.org 1101 30" Street N.W., Suite 500 Washington, D.C. 20007	 (202) 625-4387
WSFI	Wood and Synthetic Flooring Institute	(Now MFMA)
WWCCA	Western Wall and Ceiling Contractors' Assoc. 1910 N Lime St. Orange, CA 92831	www.wwcca.org (800) 903-WALL
WWPA	Western Wood Products Assoc. 1500 SW First Ave., Ste 870 Portland, OR 97201	www.wwpa.org (503) 224-3930
WWPA	Woven Wire Products Assoc. P.O. Boc 424 Mason, OH 45040	www.wovenwire.org

Federal Government Agencies: Names and titles of Federal Government standards or specification producing agencies are often abbreviated. The following abbreviations and acronyms referenced in the Contract Documents indicate names of standards or specification producing agencies of the Federal Government. Names and addresses are subject to change and are believed, but are not assured, to be accurate and up-to-date as of the date of the Contract Documents.

CE	Corps of Engineers (U.S. Army Corps of Engineers) General Information Referral 441 G St. NW Washington, DC 20314-1000	www.usace.army.mil (202) 761-0011
CFR	Code of Federal Regulations (Available from the Government Printing Office) 732 N. Capitol St., NW Washington, DC 20401 (Material is usually published first in the "Federal Register.")	www.gpo.govaccess.gov (202) 512-0000
CPSC	Consumer Product Safety Commission East West Towers 4330 East-West Hwy Bethesda, MD 20814	www.cpsc.gov (800) 638-2772
CS	Commercial Standard (Building Energy Codes and Standards)	www.energycodes.gov

	Government Printing Office Washington, DC 20402	(202) 512-0000
DOC	Department of Commerce 14th St. and Constitution Ave., NW Washington, DC 20230	www.commerce.gov (202) 482-2000
DOT	Department of Transportation 1200 New Jersey Ave, SE Washington, DC 20590	www.transportation.gov (855) 368-4200
EPA	Environmental Protection Agency 1200 Pennsylvania Ave. NW Washington, DC 20460	www.epa.gov (202) 260-2090
FAA	Federal Aviation Administration (U.S. Department of Transportation) 800 Independence Ave., SW Washington, DC 20591	www.faa.gov (202) 366-4000
FCC	Federal Communications Commission 1919 M St., NW Washington, DC 20554	www.fcc.gov (202) 418-0190
FDA	Food and Drug Administration 5600 Fishers Lane Rockville, MD 20857	www,fda.gov (888) 463-6332
FHA	Federal Housing Administration (U-S- Department of Housing and Urban Development) 451 Seventh St., SW Washington, DC 20410	www.hud.gov (202) 708-1112
FS	Federal Specification Unit (Available from GSA) 470 East L'Enfant Plaza, SW, Suite 8100 Washington, DC 20407	(202) 755-0325
GSA	General Services Administration F St. and 18th St., NW Washington, DC 20405	www,gsa.gov (202) 708-5082
HUD D	Department of Housing and Urban Development	www.hud.gov (202) 708-1112
LBNL	Lawrence Berkeley National Laboratory	www.lbl.gov (510) 486-5605
MIL	Military Standardization Documents (U.S. Department of Defense) Defense Printing Service 700 Robbins Ave., Building 4D Philadelphia, PA 19111	
NISI	National Institute of Standards and Technology (U.S. Department of Commerce) Building 101, #A1134 Rte. 1-270 and Quince Orchard Rd. Gaithersburg, MD 20899	www.nist.gov
OSHA	Occupational Safety and Health Administration (U.S. Department of Labor) 200 Constitution Ave., NW Washington, DC 20210	www.osha.gov
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, DC 20402	www.commerce.gov (202) 512-0000
RUS	Rural Utilities Service	(See USDA)

	(Formerly Rural Electrification Administration) (U.S. Department of Agriculture) 14th St. and Independence Ave., SW Washington, DC 20250	(202) 720-9560
TRB	Transportation Research Board	www.nas.edu/trb (202) 334-2934
USDA	U.S. Department of Agriculture 14th St. and Independence Ave., SW Washington, DC 20250	www.usda.gov (202) 720-2791
USPS	U.S. Postal Service 475 L'Enfant Plaza, SW Washington, DC 20260-0010	www.usps.com (202) 268-2000

1.08 DRAWING SYMBOLS

A. General: Except as otherwise indicated, graphic symbols used on drawings are those symbols recognized in the construction industry for purposes indicated. Where not otherwise noted, symbols defined by "Architectural Graphic Standards", published by the American Institute of Architects (MA) and John Wiley & Sons, Inc., latest edition. Refer instances of uncertainty to Architect for clarification before proceeding.

B. Mechanical/Electrical Drawings: Graphic symbols used in Mechanical/Electrical Drawings are generally aligned with symbols recommended by American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE). Where appropriate, those symbols are supplemented by more specific symbols as recommended by other recognized technical organizations, including, but not limited to American Society of Mechanical Engineers (ASME), American Society of Professional Engineers (ASPS), Institute of Electrical and Electronic Engineers (IEEE) and similar organizations. Refer instances of uncertainty to Architect for clarification before proceeding.

1.09 GOVERNING REGULATIONS/AUTHORITIES

A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

1.10 SUBMITTALS

A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 01 42 19

SECTION 01 45 29 TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 SCOPE

A. A qualified independent testing laboratory and/or geotechnical engineering service, selected by the Owner, approved by the Architect, and paid by the Owner, will perform the ORIGINAL professional testing and laboratory services herein. RE-TESTING of any material required by this section which fail ORIGINAL testing requirements shall be scheduled and paid for by the Contractor.

B. The inspecting agency shall make all inspections and perform all tests in accordance with the rules and regulations of the building code, local authorities, Specifications of the ASTM, and these Contract Documents.

C. Materials and workmanship not meeting the required standards or performance obligations are to be removed and replaced. Replacement and subsequent testing shall be at the expense of the Contractor.

D. Where the terms “Inspector” and “Laboratory” are used, they mean and refer to an officially designated and accredited inspector of the testing laboratory or geotechnical service engaged by the Owner.

E. Testing, inspection, and certifications specified in other sections of these Specifications shall be paid by the Contractor, unless otherwise indicated, and shall be by agencies approved by the Architect.

F. Inspection by laboratory shall not relieve Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.

1.02 RESPONSIBILITIES OF CONTRACTOR

A. See respective technical sections for specific requirements.

B. Deliver to laboratory, without cost to Owner, adequate quantities of representative samples of materials proposed for use, which are required to be tested.

C. Advise laboratory and Architect sufficiently in advance of construction operations allow laboratory to complete any required checks or tests and to assign personnel for field inspection and testing as specified.

D. Provide adequate facilities for safe storage and proper curing of concrete test samples on project site for the first 24 hours and also for subsequent field curing as required by ASTM Specifications C 31.

E. Furnish such nominal labor and equipment as required to assist laboratory personnel in obtaining and handling samples at the site and in accessing work for inspection.

F. Furnish concrete mix designs, in accordance with ACI 301, Section 3.9, made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, the laboratory shall be selected and paid by the Contractor.

G. Obtain required inspections or approvals of the building official. All inspection requests and notifications required by building code are responsibility of Contractor.

H. Provide current welder certifications for each welder to be employed.

I. Furnish fabrication/erection inspection and testing of all welds in accordance with AWS D1.1, Chapter 6.

J. Pre-qualification of all welding procedures to be used in executing the work.

K. Re-testing: Should the results of the initial laboratory tests indicate that the material or workmanship fails to comply with the requirements of the specification, the work shall be removed and reworked until it does satisfy the requirements. The final results shall be verified acceptable by owner's testing lab test which shall be paid for by the contractor. All re-testing expenses made necessary due to substandard workmanship or materials will be paid for by the Contractor.

1.03 AUTHORITY AND DUTIES OF LABORATORY PERSONNEL

A. A representative of the testing laboratory, who has reviewed and is familiar with the project and specifications, shall participate in all preconstruction conferences. He shall coordinate material testing and inspection requirements with the Contractor and his subcontractors consistent with the planned construction schedule. The laboratory representative shall attend, throughout the course of the project, such conferences as may be required or requested to address quality control issues.

B. Laboratory personnel shall inspect and/or test materials, assemblies, specimens, and work performed, including design mixes, methods and techniques and report to the Architect the progress thereof.

C. If the material furnished and/or work performed fails to meet requirements of Contract Documents, laboratory inspector shall promptly notify both the Contractor and the Architect of such failure.

D. Laboratory technicians do not act as foremen, or perform other duties for Contractor. Work will be checked as it progresses, but failure to detect any defective work or materials shall not, in any way, prevent later rejection when such defect is discovered.

E. Laboratory inspector is not authorized to revoke, alter, relax, enlarge, or release any requirement of Contract Documents or to approve or accept any portion of the work, except where such approval is specifically called for in the Specifications.

F. Comply with all building code requirements for "Special Inspection" whether or not such inspections are specified herein.

1.04 SUBMITTALS

A. Submit copies of reports of each and every inspection and test as follows: Owner-one, Contractor-two, Architect-one, and Engineer-one.

B. State in report all details of each inspection and test. Indicate compliance or noncompliance with requirements of the Contract Documents. Also state in report any and all unsatisfactory conditions.

C. In addition to furnishing a written report, notify the Architect and the Contractor verbally of any uncorrected conditions or failures to comply with the requirements of the Contract Documents.

D. At completion of each trade or branch of work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of work and full compliance with requirements of Contract Documents.

E. Submit copies of test results, sealed by a Registered Engineer, to municipal authorities having jurisdiction, as required.

1.05 REFERENCED STANDARDS

A. Latest adopted edition of all standards referenced in this Section shall apply, unless noted otherwise. In case of conflict between these Contract Documents and a referenced standard, Contract Documents shall govern. In case of conflict between these Contract Documents and the Building Code, the more stringent shall govern.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION 01 45 29

SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, and any addenda issued during bidding apply to work of this Section. See Section 01 00 00 for additional requirements.

B. Nothing in this section is intended to limit the type and amount of temporary work required, and no omissions from this Section will be recognized as an indication that such temporary activity is not required for successful completion of the work and compliance with requirements of the Contract Documents.

C. Provisions of this Section are applicable to, but are not limited to the temporary power, temporary water, temporary heat, field office, mobile telephone, sanitary facilities, storage facilities, signs, barriers, security, construction fence, cleaning, firs aid facilities, fire protection, construction aids, parking facilities, storm water control and pollution prevention plan, as further expanded in this Section.

1.02 SUMMARY

A. Provide the following temporary work as it is required by the documents or by State or Federal laws, ordinances or codes:

1. Protection for property and persons
2. Field offices with all utilities
3. Storage facilities
4. Water, gas, electricity and drainage required for construction operations.
5. Telephone for incoming and outgoing communication.
6. Scaffolding.
7. Hoists.
8. Shoring and underpinning.
9. Control of water infiltration.
10. Trash Dumpster(s)
11. Project signs.
12. Layout of the work.
13. Filter Fabric Fence
14. Reinforced Filter Fabric Barriers
15. Stabilized Construction Exit/Entrances

1.03 REFERENCE STANDARDS

A. The publications listed below forms a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. American Society for Testing and Materials (ASTM).

C. ASTM D-3786 - Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics - Diaphragm Bursting Strength Tester Method,

D. ASTM D-4632 - Standard Test Method for Breaking Load and Elongation of Geotextile (Grab Method).

1.04 SUBMITTALS

A. Manufacturer's catalogue sheets and other pertinent information on geotextile fabric.

1.05 NEW UTILITIES

A. The General Contractor shall provide all telephone service, water, temporary light and power complete with all wiring, lamps, and similar equipment, as required during construction and testing of building and equipment.

B. The General Contractor shall provide temporary heat in order to prevent freezing, facilitate drying, maintain proper temperature for curing the concrete floor, etc. and to avoid damage to materials in the building.

C. Owner will be responsible for payment of permanent power.

D. The General Contractor will provide computer / high speed internet connection at project site.

1.06 EXISTING UTILITIES

A. The Contractor may use the Owner’s existing electrical and water service at no charge as long as this use does not interfere with the Owner’s operations.

B. Electrical use shall be limited to available power for small tools and the Contractor shall be responsible for determining the adequacy of the Owner’s existing services.

C. Construction workers will not be allowed to use the existing telephone service in the facility.

1.03 TEMPORARY FACILITIES

A. Provide the following temporary facilities at the project site. Remove temporary facilities when they are no longer needed.

B. Contractor’s Office: The contractor will provide and maintain a field office on the premises. The office will contain a copy of all plans and specifications, a copy of all Shop Drawings, and correspondence concerning the project. Provide a conference space for project meetings (8-10 people).

C. Storage: Subcontractors shall provide and maintain suitable, substantial, watertight storage facilities in which to store materials that would be damaged by the weather. Storage space shall be of sufficient size to hold all such materials required on the site at one time, and if storage space is an outside building, it shall have floors raised at least 6 inches above the ground, on heavy joists or sleepers. Provide fenced areas for storage of materials and workmen’s parking of the sizes and at locations designated on the Drawings. Should the Contractor or subcontractor require additional storage area beyond that indicated on the Drawings, he shall arrange for such storage facilities off-campus, at no expense to the Owner. Contractor may use areas within the immediate construction area for storage only with the approval of the Owner’s Representative. However, such approval will not be given if such storage encumbers the working space, loads the structure prematurely, or exceeds the design live load for the specified area of the structure.

D. The Contractor shall provide and maintain temporary heat as required for the work during and throughout the entire period of construction to protect all work, materials and equipment against injuries from dampness and cold. The permanent HVAC systems may be utilized for this purpose after installation; however, if so utilized, the Contractor shall obtain the written permission of the Mechanical Subcontractor for the use of the HVAC equipment. The guarantee on such equipment shall not begin until Owner's acceptance of the project. Clean all equipment and provide new filters prior to Owner's acceptance of the project.

E. Fire Extinguishers: The Contractor shall provide prominently located multi-purpose type portable extinguishers, at least one in each wing on each floor and elsewhere as directed by the local fire marshal.

F. Telephones: The Contractor shall provide, install and maintain his own and the Architect's telephone service and equipment, to be located in the Field Offices. Telephones shall remain in service until the final completion of the job.

G. The Contractor is responsible for setting up and paying the temporary electricity up until permanent power is in place and energized. Permanent power will be set up with LCISD's electricity provider, LCISD will receive the bill directly from the provider, and LCISD will pay the bill outside the construction contract. At the point permanent power is achieved until substantial completion and beyond, LCISD is responsible for paying for any electrical usage costs billed by LCISD's electricity provider.

1.04 PROTECTIONS

A. Site: Unless specified or directed otherwise, carefully protect existing walks, lawns, other buildings, and other work on site, whether specifically indicated on the Drawings or not.

B. Trees and Shrubs: Protect trees and shrubs that are to remain in place from foliage, trunk and root damage that may result from construction operations. Also, protect such trees and shrubs that are to remain from the following damage:

1. Compaction of root area by equipment or material storage.
2. Truck damage by removing equipment, material storage, nailing or bolting.
3. Strangling by tying ropes or guy wires to trunks or large branches.
4. Poisoning by pouring solvents, gas, paint, etc., on or around trees and roots.
5. Cutting on roots by excavating, ditching, etc.
6. Damage of branches by improper pruning.
7. Drought from failure to water or by cutting or changing normal drainage pattern past roots.
8. Change of soil pH factor by disposal of lime base materials such as concrete, plaster, etc.
9. Do not cut roots 1½" in diameter or over. All excavation and earthwork within the drip line of trees will be done by hand.
10. All pruning will be done by Owner.

C. Special Requirement: When trees other that those approved for removal are destroyed, killed or badly damaged as a result of construction operations, the Contract sum will be reduced by the amount determined from the following International Shade Tree Conference formula: D x D x 0.7854 x $20.00, where D is the diameter of the trunk in inches of each shade tree measured 12" above grade.

D. Streets and Sidewalks: Protect streets, sidewalks, curbs, etc., as necessary to prevent damage to them. Repair any damage caused by these operations. No patching of sidewalks or curbs will be permitted. The entire section between expansion joints in which the damage occurs shall be replaced.

E. Temporary Fence: Locate a temporary fence around the project site. Project signage shall be located on the temporary fence. Coordinate with Owner.

1.05 TRAFFIC MAINTENANCE

A. Prior to start of work, Contractor shall examine the routing of construction vehicles, and the safeguards and procedures necessary to carry out the work.

B. In addition, be responsible for and observe the following conditions:

1. Be responsible for controlling construction traffic within and adjacent to the site.
2. Provide all entrances, lifts and safeguards required or necessary to the progress of the work, and effectively control such traffic to provide minimum hazard to the work and all persons. Contractor shall maintain adequate separation between construction traffic and school related traffic at all occupied campuses.
3. Route all construction equipment, trucks, and similar vehicles via existing public streets to and from the site as approved by the governing authorities, and on site as indicated on Drawings.
4. Construct and maintain temporary walks for pedestrians. Keep streets adjacent to the site open to vehicular and pedestrian traffic.
5. Maintain constant access for police, fire and ambulance service.

C. Provide and maintain for proper control of traffic and safety of all concerned:

1. All necessary barricades, suitable and sufficient lights, reflectors and danger signals.
2. Warning and closure signs, directional and detour signs.
3. All traffic control devices to be furnished and installed in compliance with the Texas Manual on Uniform Traffic Control Devices as prepared by the State Department of Highways and Public Transportation.

D. Provide on a 24-hour basis for all restricted and dangerous conditions existing on or adjacent to the site. Illuminate barricades, danger signals, warning signs and obstructions at night. Keep warning lights burning from sunset until sunrise.

1.06 PARKING

A. Parking for workmen employed on the work shall be in designated on site areas. If not enough parking onsite exists, the contractor shall make provisions for construction workers to park offsite and be transported to and from the project site.

1.07 SCAFFOLDING AND HOISTS

A. Unless coordinated and scheduled differently by the contractor, each individual subcontractor shall provide or arrange for hoists, derricks, scaffolding, tools, ladders, equipment, apparatus, etc., necessary or required to properly install work.

1.08 SHORING & UNDERPINNING

A. Unless coordinated and scheduled differently by the contractor, each individual subcontractor shall provide, maintain and be wholly responsible for temporary shoring and underpinning that is necessary to fully protect new and existing work while carrying out operations which may in any way jeopardize foundation, structure, walls, utilities, etc.

1.09 CONTROL OF WATER

A. Pumping: The Contractor shall provide suitable pumping equipment and keep excavations, pits, and other areas involved free of water that may leak, seep, or rain in. Provide pumping necessary to avoid delay or to protect work on the premises.

B. Temporary Coverings: When necessary to avoid delay or to protect existing or new work or equipment, the contractor shall provide suitable watertight coverings over windows, doors, hatchways, and such other openings admitting rain.

1.10 SIGNS

A. Construct and erect a project sign, identifying the Project, Contractor, Architect, designers and Opening Date in a manner as detailed on Drawings to be furnished by architect after award of bid(s).

B. Construction: Size of signs (1) shall be 8’ x 16’, constructed of 3/4” exterior type plywood on a suitable wood frame and mounted with bottom of sign approximately 3’ above grade. All anchors, connections, etc. shall be adequate for the required wind loads of the area. Provide temporary power and lighting for this sign.

C. Other Signs: No other projects signs shall be erected except delivery route designations and those deemed necessary by Owner’s Representative. Location and layout of these signs, if required, will be approved by the Architect and Owner. Plan on providing eight (8) 4’x8’ painted ¾” signs for these purposes.

PART 2 - PRODUCTS

2.01 FILTER FABRIC

A. The filter fabric fences are to be used to contain pollutants from overland flow. This practice shall not be used in channelized flow areas.

B. Provide woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a grab strength of 100 psi in any principal direction (ASTM D-4632), Mullen burst strength exceeding 200 psi (ASTM D-3786), and the equivalent opening size between 50 and 140, with the appropriate opening size to be selected based on the grain size characteristics of the disturbed soil. Filter fabric material shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature range of 0 degrees F to 120 degrees F. Representative Manufacturers: Mirafi Inc. or preapproved equivalent.

C. Provide woven galvanized steel wire fence with minimum thickness of 14 gauge and a maximum mesh spacing of 6 inches.

2.02 SEPARATION GEOTEXTILE

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material. Geotextile fabric shall have a minimum grab strength of 270 psi in any principal direction (ASTM D-4632) and the equivalent opening size between 50 and 140, with the appropriate opening size to be approved in the review process based on the characteristics of the disturbed material. Both the geotextile and threads shall be resistant to chemical attack, mildew and rot and shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0 degrees F to 120 degrees F. Representative Manufacturers: Mirafi Inc. or preapproved equivalent.

2.03 COARSE AGGREGATES

A. Coarse aggregates shall consist of crushed stone, gravel, crushed blast furnace slag, or combinations thereof. Aggregate shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic and injurious matter.

B. Coarse aggregates shall conform to the following gradation requirements.

Sieve Size (Square Mesh)	Percent Retained (By Weight)
2-1/2"	0
2"	0-20
1-1/2"	15-50
3/4"	60-80
No. 4	95-100

PART 3 - EXECUTION

3.01 GENERAL

A. Provide erosion and sedimentation control systems at the locations shown on the Drawings. Such systems shall be of the type indicated and shall be constructed in accordance with the requirements shown on the Drawings and set out in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sedimentation control systems are in place.

C. Regularly inspect and repair or replace components of all erosion and sedimentation control systems as specified for each type of system. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project area stabilization is accepted by the Owner. Remove erosion and sedimentation control systems promptly when directed by the Owner. Discard removed materials as required by these Specifications.

D. Remove and dispose sediment deposits at the project designated spoil site. Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state and local regulations.

E. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of construction limits. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

F. Contractor shall employ protective measures to avoid damage to existing trees to be retained on the project site. Conduct all construction operations under this Contract in conformance with the erosion control practices described in that Section.

G. To keep the street clean of mud generated by construction vehicles and equipment, Contractor shall provide stabilized construction exits at the construction site, staging, parking, storage, and/or disposal areas. Such erosion and sediment control system shall be constructed in accordance with the Detail - Stabilized Construction Exit attached hereto or shown on the Drawings, and any additional requirements shown on the Drawings and set out in this Section.

H. No clearing and grubbing or rough cutting, other than as specifically directed by the Owner to allow soil testing and surveying, shall be permitted until erosion and sedimentation control systems are in place.

I. Maintain existing erosion and sedimentation control systems located within the project site until acceptance of the project or until directed by the Owner to remove and discard the existing system.

J. Regularly inspect and repair or replace components of stabilized construction exists. Unless otherwise directed, maintain the erosion and sedimentation control systems until the project is accepted by the Owner. Remove erosion and sedimentation control systems promptly when directed by the Owner. Discard removed materials offsite.

K. Remove and dispose sediment deposits at the project designated spoil site. If a project spoil site is not designated on the Drawings, dispose of sediment offsite at location not in or adjacent to stream or flood-plane. Off-site disposal will be the responsibility of the Contractor. Sediment to be placed at the project site should be spread evenly throughout the site, compacted and stabilized. Sediment shall not be allowed to flush into stream or drainage way. If sediment has been contaminated, it shall be disposed of in accordance with existing federal, state and local rules and regulations.

L. Equipment and vehicles of the Contractor, or on-site for his use, shall be prohibited from maneuvering on areas outside of the construction limits. Damages caused by construction traffic to erosion and sedimentation control systems shall be repaired immediately.

M. Conduct all construction operations under this Contract in conformance with the erosion control practices described in the Section 01 57 13 – Erosion and Sedimentation Control.

3.02 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

3.03 CONSTRUCTION METHODS

A. Provide reinforced filter fabric barrier systems at locations specified on the Drawings in accordance with the Detail, found at the end of this Section or on the Drawings, entitled "Reinforced Filter Fabric Barrier". Filter fabric barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire support to steel fence posts (min. of 1.25 pounds per linear foot & Brinell Hardness greater the 140) or 1 -inch by 2-inch wooden stakes spaced a maximum of 6 feet apart and embedded a minimum of 8 inches. Steel post shall be made of hot rolled steel, at least 4 feet long with Tee or Y-bar sections with the surface painted or galvanized. Provide safety caps on top of metal posts. The posts shall be installed at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the reinforced filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow as shown on the Detail. Lay filter fabric along the edges of the trench. Backfill and compact trench.

D. Reinforced filter fabric shall have a minimum height of 18 inches and a maximum height of 36 inches above the natural ground.

E. The filter fabric should be provided in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, the fabric should be spliced together only at a support post with a minimum 6 inch overlap, and sealed securely.

F. Inspect sediment filter barrier systems after each rainfall, daily during periods of prolonged rainfall, and at a minimum once a week. Repair or replace damaged section immediately to restore the requirements of this Section. Remove sediment deposits when silt reaches one-third of the height of the barrier in depth or 6 inches, whichever is less.

G. Provide stabilized exits, entrances, access roads, parking areas, and other on-site vehicle transportation routes where shown on the Drawings.

H. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto area roadways. When washing is needed to remove sediment, Contractor shall construct a truck washing area. Truck washing shall be done on stabilized areas, which drain into a drainage system protected by erosion and sediment control measures.

I. Details for stabilized construction exits are shown on the Detail herein or as shown on the Drawings. Construction of other stabilized areas shall be to the same requirements. Roadway width shall be at least 30 feet and shall be sufficient for all ingress and egress to the site. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with under laying soil. Exposure of geotextile fabric to the elements between lay down and cover shall be a maximum of fourteen days to minimize damage potential.

J. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sand bags, gravel, boards, or similar methods to prevent sediment from entering area roadways, receiving stream or storm water conveyance system.

K. The stabilized areas shall be inspected and maintained daily. Provide periodic top dressing with additional coarse aggregates to maintain the required depth. Repair and clean out damaged measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto area roadways shall be removed immediately.

L. The length of the stabilized area shall be as shown on the Detail or as shown on the Drawings, but not less than 50 feet in length. The thickness shall not be less than 8 inches. The width shall not be less than full width of all points of ingress or egress.

M. Stabilization for other areas shall have the same thickness, and width requirements as the stabilized construction exit, except where specified otherwise on the Drawings. The aggregate shall be a compacted limestone base material, 8 inches in thickness, with an application of emulsified asphalt. The emulsified asphalt material shall be reapplied periodically following any regrading of the limestone surface.

N. Stabilized area may be widened or lengthened to accommodate truck washing area as required by the Contractor and approved by the Owner.

O. Alternative methods of construction, when preapproved by the Owner, may include the following.

1. Cement Stabilized Soil - Compacted cement stabilized soil or other fill material in an application thickness of at least 8 inches.

2. Wood Mats/Mud Mats - Oak or other hardwood timbers placed edge to edge and across support wooden beams which are placed on top of existing soil in an application thickness of at least 6 inches.

3. Steel Mats - Perforated mats placed across perpendicular support members.

3.04 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this Section. Include ail costs in the lump sum price.

END OF SECTION 01 50 00

SECTION 01 57 13 EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SCOPE

A. This Section describes erosion and sedimentation control and other control related practices, which shall be utilized during construction activities.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions, Special Conditions, and Division 1 Specification Sections, apply to this Section.

PART 2 — PRODUCTS NOT USED

PART 3 - EXECUTION

3.01 GENERAL

A. No clearing and grubbing or rough cutting shall be permitted until erosion and sedimentation control systems are in place.

B. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated construction area. Damages caused by construction traffic or others to erosion and sedimentation control systems shall be repaired immediately by the Contractor.

C. The Contractor shall be responsible for collecting, storing, hauling, and disposing of spoils, silt, and waste materials as specified on the Drawings and in this or other Technical Specifications and in compliance with applicable federal, state, and local rules and regulations.

D. Contractor shall conduct all construction operation under this Contract in conformance with the erosion control practices described on the Drawings, the Storm Water Pollution Prevention Plan and this Section.

E. The Contractor shall install, maintain, and inspect erosion and sediment control measures and practices as specified on the Drawings and in this and other Technical Specifications.

F. Contractor shall employ protective measures to avoid damage to existing trees to be retained on the project site.

3.02 TOPSOIL PLACEMENT FOR EROSION AND SEDIMENTATION CONTROL SYSTEMS

A. When topsoil is called for as a component of another Section, the Contractor shall conduct erosion control practices described in this Section during topsoil placement operation.

B. When placing topsoil, maintain erosion and sedimentation control systems.

C. Maintain grades, which have been previously established on areas to receive topsoil.

D. After the areas to receive topsoil have been brought to grade, and immediately prior to dumping and spreading the topsoil, the sub grade shall be loosened by disking or by scarifying to a depth of at least 2 inches to permit bonding of the topsoil to the subsoil.

E. No sod or seed shall be placed on soil, which has been treated with soil sterilization until sufficient time has elapsed to permit dissipation of toxic materials.

3.03 DUST CONTROL

A. Dust control methods shall be implemented to control dust creation and movement on construction sites and roads and to prevent airborne sediment from reaching receiving stream or storm water conveyance system, to reduce on and offsite damage, to prevent health hazards, and to improve traffic safety.

B. Contractor shall control dust blowing by utilizing one or more of the following methods:

1. Mulches bound with chemical binders.
2. Temporary vegetative cover.
3. Spray-on adhesives on mineral soils when not used by traffic.
4. Tillage to roughen surface and bring clods to the surface.
5. Irrigation by water sprinkling.
6. Barriers using solid board fences, snow fences, burlap fences, crate walls, bales of hay, or similar materials.

C. Dust control methods shall be implemented immediately whenever dust can be observed blowing on the project site.

3.04 KEEPING STREETS CLEAN

A. Contractor shall keep the streets clean of construction debris, dirt, and mud generated by construction vehicles and equipment. If necessary to keep the streets clean, Contractor shall provide stabilized construction exits at construction, staging, storage, and disposal areas. A vehicle/equipment wash area (stabilized with coarse aggregate) may be installed adjacent to the location of stabilized construction exit, as needed. Wash water shall be released into a drainage swale or inlet protected by erosion and sediment control measures.

B. In lieu of or in addition to stabilized construction exits, Contractor shall shovel and/or sweep the pavement to the extent necessary to keep the street clean. Water hosing or sweeping of debris and mud off of the street into adjacent areas is not allowed.

3.05 EQUIPMENT MAINTENANCE AND REPAIR

A. Maintenance and repair of construction machinery and equipment shall be confined to areas specifically designated for that purpose, Such designated areas shall be located and designed so that oils, gasoline, grease, solvents, and other potential pollutants cannot be washed into receiving streams or storm water conveyance systems. These areas shall be provided with adequate waste disposal receptacles for liquid as well as solid waste. Maintenance areas shall be inspected and cleaned daily.

B. On the construction site where designated equipment maintenance areas are not feasible, care shall be taken during each individual repair or maintenance operation to prevent potential pollutants from becoming available to be washed into streams or conveyance systems. Temporary waste disposal receptacles shall be provided.

3.06 WASTE COLLECTION AND DISPOSAL

A. Contractor shall formulate and implement a plan for the collection and disposal of waste materials on the construction site. The plan must designate locations for trash and waste receptacles and establish a collection schedule. Methods for ultimate disposal of waste shall be specified and carried out in accordance with applicable local, state and federal health and safety regulations. Special provisions shall be made for the collection and disposal of liquid wastes and toxic or hazardous materials.

B. Receptacles and other waste collection areas shall be kept neat and orderly to the extent possible. Waste shall not be allowed to overflow its container or accumulate for excessively long periods of time. Trash collection points shall be located where they will least likely be affected by concentrated storm water runoff.

3.07 WASHING AREAS

A. Vehicles such as concrete or dump trucks and other construction equipment shall not be washed at locations where the runoff will flow into a watercourse or storm water conveyance system. Special areas shall be designated for washing vehicles. These areas should be located where the wash water will spread out and evaporate or infiltrate directly into the ground, or where the runoff can be collected in a temporary holding or seepage basin. Wash areas shall have gravel or rock bases to minimize mud generation. These areas shall be completely cleaned up, have waste remains hauled off, and be stabilized and seeded after the area is no longer required.

3.08 STORAGE OF CONSTRUCTION MATERIALS, CHEMICALS, ETC.

A. Sites where chemicals, cements, solvents, paints, or other potential water pollutants are to be stored, shall be isolated in areas where they will not cause runoff pollution.

B. Toxic chemicals and materials, such as pesticides, paints, and acids shall be stored in accordance with manufacturers' guidelines. Groundwater resources shall be protected from leaching by placing a plastic mat, packed clay or other impervious materials on any areas where toxic liquids are to be opened and stored.

3.09 DEMOLITION AREAS

A. Demolition work, which generates large amounts of dust, shall be provided with dust control techniques to limit the transport of the airborne pollutants. However, water or slurry used to control dust shall not be allowed to run directly into watercourses or storm water conveyance systems. Methods of ultimate disposal of these materials shall be carried out in accordance with applicable local, state and federal health and safety regulations.

3.10 SANITARY FACILITIES

A. The construction site must be provided with adequate sanitary facilities for workers in accordance with Division 1 and applicable health regulations.

3.11 PESTICIDES

A. The use of pesticides shall be approved by the Owner prior to application. A one-week notice will be required of the Contractor.

B. Pesticides used during construction shall be stored and used in accordance with manufacturers' guidelines and with local, state and federal regulations. Overuse of pesticides, which could generate contaminated runoff, shall be avoided and great care shall be taken to prevent accidental spillage, Pesticide containers shall never be washed in or near flowing streams or storm water conveyance systems.

3.12 PROTECTION OF TREES IN CONSTRUCTION AREAS

A. Heavy equipment, vehicular traffic, and stockpiles of construction materials, including topsoil, are not permitted within the drip line of any tree to be retained. Contractor shall avoid all contact with trees to be retained unless otherwise directed by the Owner or required by the work under this Contract.

B. Specimen trees shown on the Drawings shall be boxed or fenced. When called for in the Drawings, tunnel under the root system for the installation of utility lines.

C. Tree trunks, exposed roots, and limbs of the trees designated to be retained, which are damaged during construction operations, will be cared for as prescribed by a forester or licensed tree expert at the expense of the Contractor.

3.13 MEASUREMENT AND PAYMENT

A. No separate measurement or payment will be made for materials and labor performed under this section. Include all costs in the lump sum price, or in the unit price for Storm Water Pollution Prevention Plan.

END OF SECTION 01 57 13

SECTION 01 60 00 PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Materials

B. Verification of Non-Contamination

C. Transportation and handling.

D. Storage and protection.

E. General Material Requirements
1. “or Equal” defined
2. Color, Texture or Pattern Requirements
3. Plumbing Line Protection
4. Fasteners
5. Exposed Metal Work

PART 2 - PRODUCTS

2.01 MATERIALS

A. Do not use materials and equipment removed from existing premises, except as specifically permitted by the Contract Documents.

B. Provide interchangeable components of the same manufacture, for components being replaced.

C. Products include material, equipment, and systems.

D. Comply with Specifications and referenced standards as minimum requirements.

E. All products shall be new and suited to the use intended except where noted otherwise.

F. All products shall be free of all logos, manufacturers' name plates, and stencils on surfaces exposed to view in the finished Work.

G. The use of products containing asbestos will not be acceptable.

2.02 VERIFICATION OF NON-CONTAMINATION

A. Refer to Section 01 10 00 for requirements concerning use of asbestos containing materials, lead, and PCB's in the Project. For each of the materials provided, submit a copy of the certification forms at the end of Section 01 10 00 - Miscellaneous Requirements completed by the Contractor and installing Subcontractor, and a letter from the manufacturer indicating that products are totally free of asbestos, lead, and PCB's.

2.03 TRANSPORTATION AND HANDLING

A. Transport and handle Products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

C. Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

2.04 STORAGE AND PROTECTION

A. Store and protect Products in accordance with manufacturers' instructions, with seals and labels intact and legible.

B. Store sensitive Products in weather tight, climate controlled enclosures.

C. For exterior storage of fabricated Products, place on sloped supports, above ground.

D. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

E. Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of Product. Replace all insulation material and gypsum board products that become wet.

F. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter. Cover to prevent high winds from turning material into a missile.

G. Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

H. Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

2.05 GENERAL MATERIAL REQUIREMENTS

A. For purposes of this Project, the term “OR EQUAL” is defined as follows:

1. Any material or equipment that will fully perform the duties specified will be considered ‘equal,’ provided the bid submits proof that such material or equipment is of equivalent substance and function and is approved, in writing.

2. Requests for the approval of ‘or equal’ shall be made in writing at least five business days prior to bid opening. During the bidding period, all approvals shall be issued by the Architect/Engineer in the form of addenda at least two business days prior to the bid opening date.”

3. For products specified by name and accompanied by the term ‘or equal,’ or ‘or equivalent,’ or ‘or approved equal,’ or ‘or approved,’ comply with requirements in Section 01 33 00 - Submittal Procedures’ for submitting a substitution request to obtain approval for use of an unnamed product. These substitution requests must be submitted at least 5 days prior to the bid date.”

A. Color, Texture, or Pattern Requirements:
1 When color, texture, or pattern is specified, the item, product, or material shall be furnished in the specified color, texture, or pattern, as applicable.

2. When more than one (1) approved manufacturer is named in the Specifications, Contractor may select any of the approved manufacturers and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect's review and selection.

3. When the term "match existing", or any derivative thereof appears in the Contract Documents, it means that the sample must match the Owner's existing work in every respect as to color, texture, and pattern, as applicable.

4. When the term "match Architect's approved sample", or any derivative thereof appears in the Contract Documents, it means that the Architect has selected a sample which must be matched in every respect as to color, texture, and pattern, as applicable.

5. When an item or product is specified of a manufacturer for which only one (1) color, texture, or pattern is available, and a color, texture, or pattern other than that one is specified, Contractor shall bring it to the attention of the Architect for a decision prior to proceeding with the work. Do not proceed with the work until Architect has approved the color, texture, and pattern, as applicable.

6. When an item or product is specified of a manufacturer for which no color, texture, or pattern is specified, and colors, textures, and patterns are available, Contractor shall bring it to the attention of the Architect and submit the full range of colors, textures, and patterns (standard and special) available of that manufacturer for the Architect's review and selection. Do not proceed with the work until Architect has selected and approved the color, texture, and pattern, as applicable.

7. When due to the nature of the item, product, or material, i.e. face brick, tile payers, natural stone, etc. Contractor shall submit sample or samples which exhibit the full range of characteristics (colors, i.e. lights and darks. as well as textures, and patterns) for which the item, product, or material is available. The Architect will select the color, texture, and pattern, as applicable, from those available and request a sample panel exhibiting the approved characteristics. The approved color range, texture, and pattern, as applicable will then become the standard for which all work on the project will be judged. Architect will be final judge as to having performed work in conformance with approved characteristics.

8. Under no circumstances are colors, textures, patterns, or any other characteristics for which an item, product, or material are available to be selected by anyone other than the Architect or his authorized representative.

9. Non-conforming work shall be removed from the site and replaced with new conforming work at no additional expense to Owner.

B. Plumbing Line Protection:

1. Placing or washing materials, including, but not limited to the following, down any plumbing line or fixture is strictly forbidden.

   a. Concrete, cement, sludge, mortar, grout, plaster, or any other cementitious material

   b. Paint, paint thinner, turpentine, kerosene, gasoline, oil, or any other petroleum or hazardous products.

2. Cleaning painting equipment, including brushes in new or existing plumbing fixtures is strictly prohibited.

3. If requested. Contractor shall certify that all affected plumbing lines and fixtures are clean, free flowing and running. Plumbing lines and fixtures damaged as a result of any of the above shall be repaired or replaced at no expense to Owner. Contractor shall bear responsibility and all costs of fines, penalties, and legal fees attributed to violations as levied by authorities having jurisdiction.

C. Support from Structure: Ducts, pipes, conduits, equipment, and other items indicated to be supported from the structure shall be accomplished using approved hang wires, hangers, or devices of type, size and material recommended to suit the application and installed in accordance with recommendations of the hanger or device manufacturer, Architect and/or Structural Engineer, or code authorities having jurisdiction, whichever is the more stringent requirement. Nothing shall be hung from the structure unless directed to do so by the Architect and/or Structural Engineer.

D. Ducts, Pipes, Conduits, and Wires: Shall be concealed in walls, chases, and enclosed areas out of view, unless specifically indicated as exposed or where exposure is required for proper function of item, such as air registers, air returns, louvers, grilles, vents, thermostats, electrical receptacles, telephone/data terminals and jacks. light switches, etc. Refer instances of uncertainty to Architect for clarification before proceeding.

E. Fasteners:

1. Unless specifically indicated or directed otherwise, all fasteners in work exposed to view, shall be concealed in the finished work.

2. No fasteners shall show through or telegraph through exposed face of finished work and all finished surfaces shall be free of all evidence of the existence of fasteners.

3. Fasteners shall be spaced to accurately and rigidly secure work in place.

4. If not shown or otherwise required or recommended by manufacturer, standard, or code authorities having jurisdiction, fastener spacing shall not exceed 12 inches on center.

5. Non-conforming work shall be- removed from the site and replaced with new conforming work at no additional expense to Owner.

F. Exposed Metal Work:

1. Unless specifically indicated or directed otherwise, all exposed metal work shall be flat with all surfaces free of distortions, oil canning, waves, dents, scratches, weld marks, and other surface defects detrimental to good appearance or function.

2. All steel exposed to exterior shall be hot-dip galvanized, phosphate treated for paint retention and shop prime painted.

3. Non-conforming work shall be removed from the site and replaced with new conforming work at no additional expense to Owner.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01 60 00

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes procedural requirements for cutting and patching.

1.02 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.01 SECTION INCLUDES

A. General: Contractor shall take reasonable care prior to all cutting and drilling in order to minimize unintended damage to concealed conduits, cables, pipes, reinforcing steel, etc.

B. The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition prior to the cutting, fitting and patching unless otherwise required by the Contract Documents.

C. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

D. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational Elements include the following:

1. Air or smoke barriers.
2. Fire-protection systems.
3. Control systems.
4. Communication systems.
5. Conveying systems.
6. Electrical wiring systems.
7. Operating systems of special construction in Division 13 Sections.

E. Miscellaneous Elements: Do not cut and patch elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous Elements include the following:

1. Water, moisture, or vapor barriers.
2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

F. The Contractor shall not damage or endanger any portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction or by excavation.

G. The Contractor shall not cut or otherwise alter such construction by the Owner or by a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld.

H. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

I. No cutouts, access doors or mechanical or electrical devices of any sort shall be installed in finish materials or areas other than within mechanical rooms and shafts without specific prior approval of location and samples or catalogue cuts submitted by the Contractor.

J. General Contractor shall be responsible for all cutting, patching and fitting of the Work or work under construction, coordinating installation or connection of the Work to existing facilities, or uncovering work for access, inspection or testing and related submittals.

1.02 MEASUREMENT AND PAYMENT FOR UNIT PRICE WORK

A. UNIT PRICES

1. No separate payment will be made for cutting and patching. Include cost in unit price for related items.

1.03 CUTTING AND PATCHING

A. Perform activities to avoid interference with facility operations and work of others in accordance with Document 00 70 00 - General Conditions of Contract.

B. Execute cutting and patching, including excavation, backfill and fitting to:

1. Remove and replace defective work or work not conforming to Drawings and Specifications;

2. Take samples of installed work as required for testing;

3. Remove construction required to provide for specified alterations or additions to existing work;

4. Uncover work to allow inspection or reinspection by Project Manager or regulatory agencies having jurisdiction;

5. Connect uninstalled work to completed work in proper sequence;

6. Remove or relocate existing utilities and pipes that obstruct work;

7. Make connections or alterations to existing or new facilities;

8. Provide openings, channels, chases and flues and cut, patch, and finish; if required; or

9. Provide protection for other portions of the Work.

C. Restore existing work to a condition equal to or better than that which existed prior to cutting and patching, and to standards required by Specifications.

D. Support, anchor, attach, match, trim and seal materials to work of others. Unless otherwise specified, Furnish and Install sleeves, inserts, and hangers required for execution of the Work.

E. Provide shoring, bracing and support necessary to maintain structural integrity and to protect adjacent work from damage during cutting and patching. Request written approval from Project Manager, before cutting structural members such as beams, anchors, lintels, or other supports. Follow approved submittals, as applicable.

F. Match new materials to existing materials by bonding, lapping, mechanically tying, anchoring or other effective means in order to prevent cracks and to minimize evidence of patching. Conceal effects of demolition and patching by blending new construction to existing surfaces. Avoid obvious breaks, joints or changes of surface appearance unless shown on Drawings or authorized by Project Manager.

1.04 SUBMITTALS

A. Conform to requirements of Section 01 33 00 - Submittal Procedures.

B. Submit a written request to Project Manager for consent to proceed, before conducting cutting operations that might affect structural integrity, design function, City operations, or work of another contractor.

C. Include the following in submittal:
1. Identification of Project
2. Description of affected work
3. Necessity for cutting
4. Effect on other work and on structural integrity
5. Describe the proposed work including:
    a. Scope of cutting and patching
    b. Contractor, Subcontractor or Supplier who will execute the work
    c. Proposed Products
    d. Extent of refinishing
    e. Schedule of operations
6. Alternatives to cutting and patching

D. When work conditions or schedules dictate the need for change of materials or methods, submit a written recommendation to Project Manager that includes:
1. conditions necessitating the change;
2. recommendations for alternative materials or methods; and
3. submittals required for proposed substitutions

E. Notify Project Manager in writing when work will be uncovered for observation. Do not begin cutting or patching operations until authorized by Project Manager.

1.05 CONNECTIONS TO EXISTING FACILITIES

A. Perform construction operations necessary to complete connections and tie-ins to existing facilities. Keep existing facilities in continuous operation unless otherwise permitted in the Specifications or approved in writing by Project Manager.

B. Coordinate interruption of service requiring connection to existing facilities with Project Manager. Do not bypass wastewater or sludge to waterways. Provide temporary pumping facilities to handle wastewater if necessary. Use temporary bulkheads to minimize disruption. Provide temporary power and piping to facilitate construction where necessary.

C. Submit a detailed schedule of proposed connections, including shut-downs and tie-ins. Include proposed time and date as well as anticipated duration of work. Coordinate the connection schedule with the construction schedule.
1. Submit specific times and dates to Project Manager at least 48 hours in advance of proposed work.

D. Procedures and Operations:
1. Operate existing pumps, valves and gates in required sequence under supervision of Project Manager. Do not operate valves, gates or other items of equipment without Project Manager's knowledge.
2. If possible, test equipment under operating conditions before making final tie-ins to connect equipment to existing facility.
3. Coordinate work and schedules. Notify Project Manger at least 48 Hours before shutdowns or bypasses are required.

1.06 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections of these Specifications.

B. Existing and In-Place Materials: Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, shall match the visual and functional performance of existing materials.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to prevent interruption of services to occupied areas.

1. If existing services to occupied areas must be interrupted, coordinate and receive approval of the interruption of services prior to starting work.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.

2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.

3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Division 31 Sections where required by cutting and patching operations.

5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that shall eliminate evidence of patching and refinishing.

   a. Clean piping, conduit, and similar features before applying paint or other finishing materials.

   b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

SECTION 01 74 23 FINAL CLEANING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.02 SUMMARY

A. Keep premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials and clean all exposed surfaces including crawl spaces; leave project clean and ready for occupancy.

C. Maintain project in accord with State and Local safety, health and insurance standards.

1.03 RELATED WORK IN OTHER SECTIONS

A. Temporary Protection

B. Finish Materials: Various other Sections

PART 2 - MATERIALS

2.01 GENERAL REQUIREMENTS

A. Cleaning materials: Use cleaning materials recommended by manufacturer of surface to be cleaned.

PART 3 - EXECUTION

3.01 HAZARDS CONTROL

A. Store volatile waste in covered metal containers, and remove from premises daily.

B. Prevent accumulation of waste, which creates hazardous conditions. Provide adequate ventilation during use of volatile or noxious substances.

3.02 DISPOSAL

A. Salvageable materials, including but not limited to, fill, riprap, road materials, etc. identified to be retained by Owner will be delivered to location designated. Remove other waste materials, debris and rubbish from site and legally dispose of in dumpster provided.

B. Do not burn or bury rubbish and waste materials on project site.

C. Do not dispose of volatile waste such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

D. Do not dispose of waste into streams or waterways.

E. Do not dispose of excess concrete on the project site.

3.03 DUST ABATEMENT

A. Wet down materials and rubbish to lay dust and prevent it from blowing.

3.04 SITE CLEANING/APPEARANCE

A. All walks, drives and streets outside the construction fence shall be kept clean of dirt, mud, debris, building materials, etc. at all times.

B. The Contractor will immediately clean any mud tracked out of the construction area by vehicles or equipment.

C. The Contractor will keep the entire construction area clean and at least weekly, conduct a general clean up operation.

D. The Contractor will keep the grass/weeds cut at all times within limits of construction. Minimum time interval during growing season is two weeks.

E. Periodically inspect, tighten and realign construction/tree protection fencing.

3.05 CONTAINERS AND HANDLING

A. Provide on site containers for collection of waste materials, debris and rubbish. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

3.06 SPECIAL REQUIREMENTS

A. Owner’s waste containers located inside or outside of construction limits will not be used by the Contractor, or covered, fenced in or otherwise made inaccessible for use by the Owner’s forces.

3.07 FINISH WORK

A. Vacuum clean interior areas when ready to receive finish painting, and continue vacuum cleaning on an as-needed basis until building is ready for beneficial occupancy or final acceptance.

B. Verify any Owner final cleaning and finishing requirements such as floor cleaning and waxing.

3.08 REPAIRS

A. Repair, patch and touch up marred surfaces to specified finish to match adjacent surfaces.

3.09 EXISTING AREAS

A. Existing areas of building interior and exterior which are outside contract limits, but are soiled as a result of the work under this Contract, shall be cleaned and restored to original condition.

END OF SECTION 01 74 23

SECTION 01 77 00

CLOSEOUT PROCEDURES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 - GENERAL

1.01 PRE-CLOSEOUT MEETING

A. Pre-Closeout Meeting: Schedule and convene Pre-Closeout Meeting with Owner and Architect in accordance with Section 01 31 19, Project Meetings.

1.2 SUBSTANTIAL COMPLETION

A. The items listed, Section 00 73 00 LCISD Supplementary Conditions, Paragraph 9.8 and the following items shall be completed before Substantial Completion will be granted:
   1. Contractor's Completion List (Punch List): Submit a thorough list of items to be completed or corrected, along with a written request for Substantial Completion and for review of the Work or portion of the Work. The Architect/Engineer's Project Representative, at their discretion, may attend and assist in the preparation of the Contractor's Punch List.
   2. Architect's Supplemental Punch List: The Architect/Engineer, along with the Owner at the Owner's discretion, will inspect the Work utilizing the Contractor's prepared Punch List, noting completed items and incomplete items, and will prepare a supplemental list of items that have been omitted or incomplete items that were not previously noted.
   3. Operations and Maintenance Manuals: Submit as described in Section 01 78 39 Project Record Documents.
   4. Final Cleaning: Provide final cleaning and adequate protection of installed construction as described herein.
   5. Starting of systems: Start up equipment and systems as described in herein.
   6. Testing and balancing: Testing and balancing of systems must be performed and completed by Owner's forces, and the report submitted and accepted by Architect/Engineer and Owner, as described in the Contract Documents. Make adjustments to equipment as required to achieve acceptance.
   7. Demonstrations: If required by individual specification sections or by Owner, provide demonstrations and instructions for use of equipment as described herein.

B. Date of Substantial Completion: Complete or correct items identified on Punch List and confirm that all items have been corrected prior to Architects re-inspection. Architect/Engineer, along with the Owner, will re-inspect the corrected work to establish the Date of Substantial Completion. Incomplete items remaining will be appended to the Certificate of Substantial Completion (AIA G704). The Date of Substantial Completion represents day one (1) of the closeout period, and represents the date of commencement of the Contractors correctional period and all warranty periods as described and required by the Contract Documents, except as amended in the Certificate of Substantial Completion and elsewhere in the Contract Documents.

C. Certificate of Substantial Completion: When the Work or designated portion thereof is substantially complete, Architect will prepare the Certificate of Substantial Completion to be executed by the Owner and Contractor. Items on the appended Punch List shall be completed or corrected within the time limits established in the Certificate.

1.4 PROJECT CLOSEOUT

A. Final Payment will not be authorized by the Architect until the Architect finds the Work acceptable under the Contract Documents, subject to the completion and acceptance of the following requirements and other applicable Contract requirements:
   1. Close-out Documents: Provide bound closeout documents as described in Section 01 78 39 Project Record Documents. Refer to 00 73 00, LCISD Supplementary Conditions, Paragraph 9.10 for additional information.
   2. Record Documents: Submit as described in Section 01 78 39 Project Record Documents.
   3. Extra materials: Provide extra stock, materials, and products as described in herein when required by individual specification sections.
   4. Locks: Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.
   5. Temporary Facilities: Discontinue and remove temporary facilities from the site, along with mockups, construction aids, and similar elements.
   6. Warranties, Certificates and Bonds: Execute and assemble transferable warranty documents, certificates, and bonds from subcontractors, suppliers, and manufacturers as described in herein.
   7. Final Inspection and Acceptance by Architect is achieved as described herein.

1.6 FINAL CLEANING

A. Execute final cleaning prior to final project inspection and acceptance.

B. Clean interior and exterior glass, and surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces, mop hard floor surfaces.

B. Remove smudges, marks, stains, fingerprints, soil, dirt, spots, dust, lint, and other foreign materials from finished and exposed surfaces

C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

D. Clean and replace filters of operating equipment as required by Contract Documents

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and temporary construction facilities from site.

1.7 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections until Work is accepted by Architect and Owner.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.8 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Owner 48 hours prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of Contractors' personnel, and installer in accordance with manufacturers' instructions.

G. When specified in individual specification sections or required by manufacturer, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. When specified in individual specification sections or required by Owner or Architect/Engineer, submit a written report in accordance with Section 01300, Submittal Procedures, that equipment or system has been properly installed and is functioning correctly.

1.9 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel a minimum of 48 hours prior to date of Final Completion in accordance with Owner’s requirements.

B. Demonstrate Project equipment instructed by qualified manufacturer's representative who is knowledgeable about the Project and equipment.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six (6) months.

D. Utilize maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment.

F. Prepare and insert additional data in maintenance manuals when need for additional data becomes apparent during instruction.

G. Review and verify proper star-up and operation of equipment prior to scheduling demonstrations with Owner.

1.10 PROJECT RECORD DOCUMENTS

A. Record Documents, as described in Section 01 78 39, shall be submitted at Project Closeout. Final Payment will not be authorized by the Architect until final review and acceptance by Architect and Engineers is achieved in accordance with the Owners requirements.

B. At the Contractors request, and with associated fee, Architect may provide electronic versions of the construction drawing and specification files for Contractors use, subject to the terms and conditions of Architects standard electronic document transfer agreement.

C. Submit reproducible to respective consultants (Civil, Structural, MEP, *etc*.) for review. Consultant will mark-up corrections and return to Contractor for final revisions. Make final revisions prior to submitting to Architect.
   1. Format: One (1) set blackline reproducibles and two (2) sets bluelines of approved reproducibles.
   2. In addition, provide the Owner with one (1) set of Record Drawings on a non-rewritable CD in AutoCAD® latest release.
   3. In PDF format on DVD media.

1.11 EXTRA STOCK, MATERIALS AND MAINTENANCE PRODUCTS

A. Furnish extra stock, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain signed receipt from Owner's authorized representative prior to final application for payment. Delivery of materials to, or obtaining receipt from anyone other than Owner's authorized representative may constitute breach of this requirement and may require delivery of additional materials at no cost to the Owner if original materials are misplaced.

C. Include signed receipts for delivery of extra stock and materials, including keys, with Closeout Documents.

1.12 WARRANTIES, CERTIFICATES AND BONDS

A. Definitions:
   1. Standard Product Warranties: preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
   2. Special Warranties: written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide coverage of specific defects, or both.

B. In accordance with the general warranty obligations under Paragraph 3.5 of the General Conditions as amended by the Supplementary Conditions, the General Contractor's warranty shall be for a period of one (1) year following the date of Substantial Completion, hereinafter called the one-year warranty period. The Contractors one-year general warranty shall include all labor, material and

C. delivery costs required to correct defective material and installation. This warranty shall not limit the Owner's rights with respect to latent defects, gross mistakes, or fraud.

D. The Contractor's one-year warranty shall run concurrently with the one (1) year period for correction of Work required under Paragraph 12.2 of the General Conditions.

E. In addition to the Contractors one-year warranty, Special Warranties as described in individual specifications sections, shall extend the warranty period for the period specified without limitation in respect to other obligations which the Contractor has under the Contract Documents.

F. Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve the suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

G. Warranty Requirements:
1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
2. When Work covered by a warranty has failed and been corrected by replacement or reconstruction, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
3. Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing defective Work regardless of whether the Owner ahs benefited from use of the Work through a portion of its anticipated useful service life.
4. Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
5. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or designated portion of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

H. Compile copies of each required warranty properly executed by the Contractor and the subcontractor, supplier, or manufacturer. Verify documents are in proper form, contain full information, and are notarized. Co-execute warranties, certificates and bonds when required and include signed warrantees with Closeout Documents submitted to the Architect.

I. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

1.13 FINAL COMPLETION AND FINAL PAYMENT

A. Final Notice and Inspection:
1. When all items on the Punch List have been corrected, final cleaning has been completed, and installed work has been protected, submit written notice to the Architect that the Work is ready for final inspection and acceptance.
2. Upon receipt of written notice that the Work is ready for final inspection and acceptance, the Architect and Engineer will make final inspection.

B. Final Change Order: When the Project Closeout items described above are successfully completed and the Work is found acceptable to Architect/Engineer and Owner, a Final Change Order will be executed. This Change Order will include any Allowance adjustments as required by the Contract Documents.

C. Final Application for Payment: When all of the above items are successfully complete, submit to the Architect a final Application for Payment and request for release of retainage.

D. Release of Retainage: Release of retainage will not be authorized by the Architect until Contractor completes all requirements for close-out to the satisfaction of the Owner and Architect as described herein.

1.14 TERMINAL INSPECTION

A. Immediately prior to expiration of the one (1) year period for correction of the Work, the Contractor shall make an inspection of the work in the company of the Architect and the Owner. The Architect and the Owner shall be given not less than ten (10) days notice prior to the anticipated date of terminal inspection.

B. Where any portion of the work has proven to be defective and requires replacement, repair or adjustment, the Contractor shall immediately provide materials and labor necessary to remedy such defective work and shall execute such work without delay until completed to the satisfaction of the Architect and the Owner, even if the date of completion of the corrective work may extend beyond the expiration date of the correction period.

C. The Contractor shall not be responsible for correction of work which has been damaged because of neglect or abuse by the Owner nor the replacement of parts necessitated by normal wear in use.

PART 2 - PRODUCTS
Not Used

PART 3 - EXECUTION
Not Used

END OF SECTION 01 77 00

SECTION 01 77 01
CLOSEOUT FORMS

CLOSE-OUT FORM "A"

SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the_____of_____, the subcontractor who supplied, installed, and /or erected the work described below, and that, he /she is duly authorized to make this Affidavit and Subcontractor Release:

   Project: Frost Elementary Interior & Exterior Renovations

   Owner: Lamar Consolidated Independent School District Architect: ERO Architects

   Work Performed:_____Specification Section(s): _____

2. That all work required under the subject subcontractor of the subject construction project has been performed in accordance with the terms thereof, that all material men, sub-subcontractors, mechanics, and laborers have been paid and satisfied in full and that there are no outstanding claims of any character arising out of the performance of said subcontractor which have not been paid and satisfied in full.

3. That to the best of his / her knowledge and belief, there are no unsatisfied claims for damages resulting from injury or death to any employees, sub-subcontractors, or the public at large arising out of the performance of said subcontract, or any suits or claims for any other damages of any kind, nature, or description which might constitute a lien upon the property of the Owner.

4. That he / she has received full payment of all sums due him / her for materials furnished and services rendered by the undersigned in connection with the performance of said subcontract and has and does hereby release the Owner and the Architect and his consultants and the Contractor from any and all claims of any character arising out of or in any way connected with performance of said subcontract.

ATTEST (If Corporation)

_____
Name of Subcontractor

_____ _____
Secretary (By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this_____day of_____, 20_____.

(Seal)

_____
(Notary Public Signature)

CLOSE OUT FORM "B"

CERTIFICATION OF PROJECT COMPLIANCE

Completion of this form is required under the provisions of §61.1036(c)(3)(F) TAC for all public school district construction projects. Instructions for completion of this form can be found on page 2.

1. PROJECT INFORMATION

DISTRICT:

Facility:

ARCHITECT/ENGINEER:

Address:

CONTRACTOR/CM:

City:

CONTRACT DATE:

DATE DISTRICT AUTHORIZED PROJECT:

BRIEF DESCRIPTION OF PROJECT:

2. CERTIFICATION OF DESIGN AND CONSTRUCTION

The intent of this document is to assure that the school district has provided to the architect/engineer the required information and the architect/engineer has reviewed the School Facilities Standards as required by the State of Texas, and used his/her reasonable professional judgment and care in the architectural/engineering design and that the contractor has constructed the project in a quality manner in general conformance with the design requirements and that the school district certifies to project completion.

3. The District certifies that the educational program and the educational specifications of this facility along with the identified building code to be used have been provided to the architect/engineer.

DISTRICT: **BY:** **DATE:**

4. The Architect/Engineer certifies the above information was received from the school district, and that the building(s) were designed in accordance with the applicable building codes. Further, the facility has been designed to meet or exceed the design criteria relating to space (minimum square footage), educational adequacy, and construction quality as contained in the School Facilities Standards as adopted by the Commissioner of Education, June 9, 2003, and as provided by the district.

ARCHITECT/ENGINEER: **BY:** **DATE:**

5. The Contractor/CM certifies that this project has been constructed in general conformance with the construction documents as prepared by the architect/engineer listed above.

CONTRACTOR/CM: **BY:** **DATE:**

6. The District certifies completion of the project (as defined by the architect/engineer and contractor).

DISTRICT: **BY:** **DATE:**

INSTRUCTIONS FOR COMPLETION OF "CERTIFICATION OF PROJECT COMPLIANCE" FORM

Section 1. Identify the following:
- – name and address of the school facility
- – name of the school district
- – the Architect/Engineer and Contractor
- – the date of execution of the construction contract
- – the date that the school district authorized the superintendent to hire an architect/engineer
- – scope of the project.
- –

Section 2. This section outlines the intent of the document. No action required.

Section 3. This section is to be executed by the school district upon transmittal of the information (as listed) to the architect/engineer and is to remain in the custody of the school district throughout the entire project.

Section 4. This section is to be executed by the architect/engineer upon completion of the plans and specifications and in conjunction with the completion of the plan review for code compliance (ref. 19 TAC §61.1033 or §61.1036, School Facilities Standards) and returned to the school district's files.

Section 5. This section is to be executed by the contractor upon substantial completion of the project and retained in the school district's files.

Section 6. This section is to be executed by the school district upon acceptance and occupancy of the project.

NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. The school district will retain this document in their files indefinitely until review and/or submittal is required by representatives of the Texas Education Agency.

CLOSE-OUT FORM "C"

SUBCONTRACTOR HAZARDOUS MATERIAL CERTIFICATE

THE STATE OF_____

COUNTY OF _____

PROJECT: Frost Elementary Interior & Exterior Renovations

OWNER: Lamar Consolidated Independent School District

ARCHITECT: ERO Architects

SPECIFICATION SECTION(S):

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says that he / she is the

_____ of_____,the subcontractor / supplier who constructed or provided the section(s) of work referenced above, and that he / she is duly authorized to certify to the best of his / her information, knowledge, and belief no asbestos, lead or PCB containing products have been incorporated into the project.

ATTEST (If Corporation)

_____
Name of Subcontractor / Supplier

_____ _____

_____ Secretary (By)
(Title)

JURAT

THE STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this_____day of_____, 20_____.

(Seal)

_____
(Notary Public Signature)

CLOSE-OUT FORM "D"

SUBCONTRACTOR WARRANTY

STATE OF _____

COUNTY OF _____

KNOW ALL MEN BY THESE PRESENTS:

_____, being first duly sworn, deposes and says:

1. That he / she is the Subcontractor (or the_____of_____ the subcontractor) who supplied, installed, and / or erected the work described below, and that, he / she is duly authorized to make this Subcontractor Warranty:

   Project: Frost Elementary Interior & Exterior Renovations

   Owner: Lamar Consolidated Independent School District Architect:___ERO Architects___
   Work Performed:_____Specification Section(s): _____

2. The undersigned Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract are of good quality and new except where otherwise required or permitted by the Contract Documents, that the Work is free from defects not inherent in the quality required or permitted, and that the Work conforms with the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. The Subcontractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by the Subcontractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

3. In the event of failure of materials, products, or workmanship, during the specified warranty periods, the Subcontractor shall take appropriate measures to assure correction or replacement of the defective items, whether notified by the Contractor, Owner or Architect.

4. The Subcontractor warrants the work performed for a period of_____months from the date of

Substantial Completion, except as follows:_____

ATTEST (If Corporation) _____
Name of Subcontractor

_____
Secretary (By) (Title)

JURAT

STATE OF _____

COUNTY OF _____

Sworn to and subscribed before me on this_____day of_____, 20____.

_____
(Seal) (Notary Public Signature)

SECTION 01 77 02
WAIVER AND RELEASE OF LIENS

PART 1 GENERAL

1.01 SUMMARY

A. Document Includes: Applicability and use of statutory Waiver and Release of Lien forms promulgated by the Legislature of the State of Texas for construction projects in Texas.

1.02 REFERENCES

A. Texas Property Code, Chapter 53, Subchapter L, Sections 53.281 thru 53.287 (includes the standard forms attached herewith immediately following this section):
   1. Form 1: Conditional Waiver for Progress Payments
   2. Form 2: Unconditional Waiver for Progress Payments
   3. Form 3: Conditional Waiver for Final Payments
   4. Form 4: Unconditional Waiver for Final Payments

PART 2 PRODUCTS *(not used)*

PART 3 EXECUTION

3.01 SELECTION AND USE OF WAIVER AND RELEASE OF LIEN FORMS

A. Based on answers to the following questions, use the applicable form for the occasion:
   1. Is the payment a *progress* payment (partial, not final), or a *final* payment?
   2. Is the release *unconditional* (for a payment already received), or *conditional* (given in anticipation of a payment not yet received)?

B. Submit the applicable form, properly executed (filled out, signed and dated) and notarized, on each occasion required (see other portions of the Contract Documents, including but not necessarily limited to the related requirements documents cited above).

C. The wording of these forms is prescribed by the State of Texas. Questions regarding their use, execution, etc. should be directed to user's own attorney experienced in construction or lien law. This document is not to be interpreted as rendering legal advice.

D. Even if the Contract Documents do not explicitly require submittal of Waivers and Releases of Liens for every payment (for example, omitting them for monthly progress payments), the Owner reserves the right, at its sole discretion, to require applicable Waivers and Releases of Liens, executed and notarized, for any or all payments.

END OF DOCUMENT AI
(see following pages for standard forms)

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____

OWNER'S NAME:_____PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

On receipt by the signer of this document of a check from_____(maker of check) in the sum of $_____payable to_____(payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of_____(owner) located at _____ (location) to the following extent:

_____ (job description).

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to_____(person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____

_____ (Company name)

By_____(Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at_____,_____, This_____day of_____, 20____A.D.

_____

Notary Public in and for the state of _____

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS

PROJECT NAME: _____

OWNER'S NAME:_____PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT

The signer of this document has been paid and has received a progress payment in the sum of $_____for all labor, services, equipment, or materials furnished to the property or to _____ (person with whom signer contracted) on the property of _____ (Owner) located at_____(location) to the following extent:_____(job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent:

This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to_____(person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____

_____ (Company name)

By_____(Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at_____,_____, This____day of_____. 20____A.D.

_____

Notary Public in and for the state of _____

FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____

OWNER'S NAME:_____PROJECT NUMBER_____

CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

On receipt by the signer of this document of a check from_____(maker of check) in the sum of $_____payable to_____(payee or payees of check) and when the check has been properly endorsed and has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the property of_____(owner) located at _____ (location) to the following extent:

_____ (job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to the property or to_____(person with whom signer contracted).

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date _____

_____ (Company name)

By_____(Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at_____,_____, This____day of_____. 20____A.D.

_____

Notary Public in and for the state of _____

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENTS

PROJECT NAME: _____

OWNER'S NAME:_____PROJECT NUMBER_____

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

UNCONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT

Project _____

Job. No. _____

The signer of this document has been paid in full for all labor, services, equipment, or materials furnished to the property or to_____(person with whom signer contracted) on the property of_____(owner) located at_____(location) to the following extent:_____(job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position.

The signer warrants that the signer has already paid or will use the funds received from this final payment to promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date _____

_____ (Company name)

By_____(Signature)

_____ (Printed/Typed name)

_____ (Title)

SWORN AND SUBSCRIBED before me at_____,_____, This_____day of_____. 20____A.D.

_____

Notary Public in and for the state of _____

(END OF ATTACHED FORMS)

SECTION 01 78 36 WARRANTIES AND GUARANTEES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

1.02 SUMMARY

A. In addition to the requirements of the General Conditions and Supplementary General Conditions of the Contract for Construction, the Contractor and each Subcontractor shall submit to the Owner a written guarantee, prior to release of final payment on a form approved by the Architect, for the work, materials, and equipment for a one (1) year period as specified hereinafter.

B. All guarantees, including extended guarantees specified hereinafter, shall be addressed to the Owner by name, and submitted to the architect, with other “Records for Owner”, all in binders, properly labeled.

C. Warranties/guarantees shall include parts, labor, and all other costs required to repair and/or replace items that may malfunction during the Warranty/Guarantee period.

1. Initiation of Requests: The Owner will initiate a request for corrective work at the project. This is accomplished by their submission of a request to the contractor with copies sent to the Owner’s project manager. The Owner’s project manager will review the item and determine if it is a maintenance item or a warranty item. If determined to be a warranty item, he will address the Warranty Item Letter to the Contractor for action and will retain a copy in a suspense file and forward a copy to the Architect’s CA representative. The contractor is to maintain a log of warranty items reported and during the first year of Owner occupancy send a copy of the log each month to the owner and Architect for their records. At no time should a warranty item go unresolved more than 10 working days.

2. Response to Request: Upon receipt of the Warranty Item Letter, the Contractor should either initiate the repair with his work force or forward a copy to the subcontractor for action. If the Contractor forwards the action to the subcontractor, he will retain a copy in a suspense file. Prior to commencing any repairs the Contractor or subcontractor must contact the Owner prior to the visiting site.

3. Repairs and Acknowledgment of Repairs: Coordination should be made with the Owner maintenance personnel prior to commencing repairs in case they wish to be present during repairs. In any event, OWNER maintenance personnel must be present to acknowledge completion of the repair and must sign off on a copy and date it. The contractor must then send a copy of the completed item back to the Owner’s project manager. The return of the signed copy constitutes completion of the request and all file copies can be so annotated.

D. All guarantees shall be for period specified, commencing on date of acceptance of the entire project by the Owner.

E. Additional guarantee requirements are included, but not limited to, the following: (Contractor(s) shall review the documents and provide all extended Guarantees listed.

1.	Air Conditioning & Refrigeration Systems	2 years
2.	HVAC Controls	2 years
3.	Electrical Equipment	2 years
4.	Damproofing and Waterproofing	2 years
5.	Sealants	2 years
6.	Glass, Glazing, Windows	2 years
7.	Aluminum Entrances and Storefronts	2 years
8.	Painting	2 years
9.	Combination locker locks	2 years
10.	Sheet Metal & Flashing	2 years
11.	Carpet Installation	3 years
12.	Resilient Athletic Flooring (manuf. defects)	3 years
13.	Mirror Glazing	5 years
14.	Chiller Compressors	5 years
15.	Door Closures	5 years
16.	Sport Flooring	10 years
17.	Interlocking Athletic Flooring	10 years
18.	Boilers	10 years
19.	Roofing (weather tightness & finish)	20 years
20.	Metal Siding (Finish)	20 years
21.	Wood Doors (Interior)	Life of Installation
22.	Carpet	Lifetime of Installation

Until receipt of these guarantees, final inspection will not be conducted nor final payment released.

PART 2 - PRODUCTS

NOT USED

PAR 3 - EXECUTION

3.01 GENERAL

A. Contractor shall arrange for all required inspections during the warranty period. Regardless of the wording of individual warranties, the Owner shall not be responsible for notification requirements for routine inspections during the General Contractor's warranty period.

B. Upon receipt of written or verbal notice by the Owner or Architect of a deficiency, the Contractor shall promptly respond with inspection and repair during the General Contractor's warranty period.

C. The General Contractor shall be responsible for coordinating the activities of subcontractors, suppliers and manufacturers during the General Contractor's warranty period and the subcontractor/supplier/manufacturer extended warranty period.

END OF SECTION 01 78 36

SECTION 01 78 39 PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Record project reports.
5. Miscellaneous record submittals.
6. Operations and Maintenance Manuals
7. Closeout Documents

B. Related Sections include:

1. Division 01 Section “Closeout Procedures” for general closeout procedures.
2. Division 01 Section “Operation and Maintenance Data” for operation and maintenance manual requirements.

1.02 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:
   a. Initial Submittal:
      1) Submit PDF electronic files of scanned record prints and one of file prints.
      2) Submit record digital data files and one sets of plots.
      3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
   b. Final Submittal:
      1) Submit PDF electronic files through E-builder of scanned record prints and two sets of prints.
      2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Product Data: Submit annotated PDF electronic files and directories of each submittal through E.Builder.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

C. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record- keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

D. Reports: Submit written report through E-Builder indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.03 PROJECT RECORD DOCUMENT PROCEDURES

A. Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference.
   1. Do not use As Built Drawings and Specifications for Record Drawings and Specifications.

B. Recording Procedures: Update drawings and specifications on daily bases to record actual conditions. Record information concurrently with construction progress. Do not conceal Work until required information is accurately recorded.

C. Store Record Documents and samples apart from as built documents used for construction.
   1. Label and file Record Documents and samples in accordance with section number listings in Table of Contents. Label each document *PROJECT RECORD* in neat, large, printed letters.
   2. Maintain Record Documents in clean, dry and legible condition.
   3. Make Record Documents and samples available for inspection upon request of Architect.

1.04 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Accurately record information in an acceptable drawing technique.
      c. Record data as soon as possible after obtaining it.
      d. Record and check the markup before enclosing concealed installations.
      e. Cross-reference record prints to corresponding photographic documentation.
   2. Content: Types of items requiring marking include, but are not limited to, the following:
      a. Dimensional changes to Drawings.
      b. Revisions to details shown on Drawings.
      c. Depths of foundations.
      d. Locations and depths of underground utilities.
      e. Revisions to routing of piping and conduits.
      f. Revisions to electrical circuitry.
      g. Actual equipment locations.
      h. Duct size and routing.
      i. Locations of concealed internal utilities.
      j. Changes made by Change Order.
      k. Changes made following Architect's written orders.

l. Details not on the original Contract Drawings.

m. Field records for variable and concealed conditions.

n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.

5. Mark important additional information that was either shown schematically or omitted from original Drawings.

6. Note alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.

2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.

3. Refer instances of uncertainty to Architect for resolution.

4. Architect will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

a. See Division 01 Section “Project Management and Coordination” for requirements related to use of Architect's digital data files.

b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or modification.

2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.

D. Format: Identify and date each record Drawing; include the designation “PROJECT RECORD DRAWING” in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

2. Format: Annotated PDF electronic file with comment function enabled through E-Builder.

3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

4. Identification: As follows:

a. Project name.

b. Date.

c. Designation “PROJECT RECORD DRAWINGS.”

d. Name of Architect.

e. Name of Contractor.

1.05 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Indicate actual product installation where installation varies from that indicated in Specifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessaryto provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file and marked up paper copy of Specifications.

1. Submit electronic record Specifications through E-Builder.

1.06 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file through E-Builder.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.07 RECORD PROJECT REPORTS

A. Project Reports: Refer to Division 01 Section “Construction Progress Documentation” for project reports requirements.

B. Maintain one copy of each report at the Project field office.

C. Format: Submit record project reports as searchable, annotated PDF electronic file through E-Builder.

1.08 RECORD SAMPLES

A. Record Samples: Determine with Architect and Owner which submitted Samples are to be maintained as Record Samples. Maintain and mark one set to indicate date of review and approval by Architect; note any deviations or variations between reviewed sample and installed product or material.

1.09 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file. through E-Builder

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.10 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss.

1. Provide access to project record documents for Architect's reference during normal working hours. Miscellaneous record Submittals include”

a. Special measurements or adjustments.

b. Tests and inspections.

c. Design mixes.

B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked up miscellaneous record submittals through E-Builder. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

1.11 OPERATIONS AND MAINTENANCE MANUAL

A. As a requirement for Substantial Completion, the final Operation and Maintenance Manual shall be submitted to, and reviewed and accepted by the Architect prior to issuance of the Certificate.

B. Prepare 3-ring D-slant binder cover and spline with printed title "OPERATIONS AND MAINTENANCE MANUAL", title of project, and subject matter of binder when multiple binders are required.

C. Submit one (1) copy of preliminary Operations and Maintenance Manuals to respective consultants (Civil, MEP, Structural, *etc.*) for review of conformance with contract requirements prior to submitting final to Architect. Allow time for proper review.

D. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

E. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

F. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: Operation and Maintenance, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
   a. Significant design criteria.
   b. List of equipment.
   c. Parts list for each component.

d. Equipment start-up instructions
e. Operating instructions.
f. Maintenance instructions for equipment and systems.
g. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Product data.
   b. Air and water balance reports.
   c. Photocopies of warranties, certificates and bonds. Submit originals with Closeout Documents as specified below.

G. Submit one (1) final original and two (2) copies to Architect.

1.12 CLOSEOUT DOCUMENTS

A. Coordinate the following items with the requirements of the Supplementary Conditions of the Contract.

B. Prepare 3-ring D-slant binder cover and spline with printed title "CLOSEOUT DOCUMENTS", title of project, and subject matter of binder when multiple binders are required. Submit one (1) original and two (2) copies.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. The close-out documents shall be neatly organized and easily useable as determined by the Architect and Owner. Separate Close-out Documents binders from Operations and Maintenance Manuals. Documents identified as "affidavit" shall be notarized.

E. Contents: Prepare Table of Contents for each volume, with each item description identified, typed on white paper, in five (5) parts as follows:
   1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers. All General Contractor's vendors/suppliers and subcontractors that provided materials or performed any work related to this project must be listed on this form. Submit Final List of Subcontractors on Document AG.
   2. Part 2: Closeout Documents and Affidavits, include the following:
      a. AIA G707 - Consent of Surety to Final Payment;
      b. AIA G706 - Contractor's Affidavit of Payment of Debts and Claims;
      c. AIA G706A - Contractor's Affidavit of Release of Liens;
      d. Subcontractor's Release of Lien: Include contractor's, subcontractor's and direct material and equipment supplier's separate final releases. Submit on attached **Close-out Form "A"** - Affidavit of Subcontractor's Release of Lien. (attached to Section 01 77 01)
   3. Part 3: Project documents and certificates, including the following:
      a. Copy of Certificate of Substantial Completion (AIA G704);
      b. Copy of All Permits;
      c. Copy of Final Utility Bill or letter of transfer;
      d. Copy of Certificate of Occupancy;
      e. Certification of Project Compliance: Submit on **Close-out Form "B"** (attached to Section 01 77 01)**.** Owner and Architect will initiate form and

forward to Contractor for signature once Substantial Completion is established;

f. Hazardous Material Certificate: Submit on attached **Close-out Form "C"** (attached to Section 01 77 01). Affidavits from Contractor, Subcontractors and General Contractor's vendors or suppliers stating that no hazardous materials/products have been used or installed in this project.

4. Part 4: Warranties, compile sequentially based on specification sections:

   a. General Contractor's Warranty: Submit on company letterhead as described below. This Warranty shall state all sections of Work performed by General Contractor's own forces, and warranty period for each section of Work;
   b. Subcontractor's Warranty: notarized, and submitted on attached **Close-out Form "D"** (attached to Section 01 77 01). This Warranty shall state all sections of Work performed by the subcontractor and warranty period.

5. Part 5: Receipts:
   a. Extra Stock: Provide original receipts for delivery of "Extra Stock" items as described below, (if applicable). Receipts must be signed by an authorized Owner's representative;
   b. Keys: Provide original receipts for delivery of "Keys", (if applicable). Receipts must be signed by an authorized Owner's representative.

F. In addition to the three (3) required close-out binders listed above, provide Architect with one (1) separate binder for their records containing the following:
   1. Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers;
   2. all MSDS sheets for the project;
   3. all warranties from Contractor, subcontractors, direct suppliers, and manufacturers.

G. Failure to complete and close-out project after substantial completion may result in liquidated damages being assessed to the Contractor. Refer to Conditions of the Contract for additional requirements and liquidated damages.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 91 13 GENERAL COMMISSIONING

PART 1 – GENERAL

1.1 SUMMARY

A. This specification section defines the requirements for project commissioning.
   1. Requirements for this project are based on commissioning defined in the International Energy Conversation Code (IECC) 2015.

B. This section is for information only and is used to establish work defined in Sections 22 08 00, 23 08 00 and 26 08 00.

C. The Owner will procure the services of an independent Commissioning Agent and pay all necessary fees.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract including General and Supplementary Conditions apply to this section.

C. Related Specification Sections:
   1. Division 1.
   2. Division 22, all sections related to domestic hot water system and water heaters.
   3. Division 23, all HVAC sections and Cx specification Section 23 08 00.
   4. Division 26, all sections related to power, power distribution, grounding, electrical service to the building, lighting and lighting controls and Cx specification Section 26 08 00.

1.3 DEFINITIONS

A. Owner's Project Requirements (OPR): A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, commissioning, training, documentation and supporting information. The OPR is typically developed by the Owner or his representative.

B. Basis of Design (BOD): A document that records concepts, calculations, system selection decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process. The BOD is typically developed by the Architectural & Engineering team.

C. Commissioning (Cx): A systematic process that helps ensure that the designed and installed systems conform to the requirements of the OPR and BOD. The Commissioning Authority (CxA) works closely with the Owner, design team and construction team throughout the design and construction stages to ensure smooth commissioning process. The procedures used to assist the Owner and the Architect/Engineer in monitoring the installation of and facilitating the successful start-up of the building systems verifying their installation performs as designed and specified; assisting with the permanent transfer of the operation and maintenance responsibilities of the HVAC, plumbing, and electrical lighting systems to the Owner and the Owner's operating personnel. The installation is then "officially" placed into service and becomes the property of the Owner. Commissioning assists in the coordination of construction schedules and sequences to

facilitate an efficient construction process. Commissioning serves the Owner's best interests by delivering a facility with systems that perform as specified, intended, and paid for. The CxA follows procedures and guidelines outlined in the Cx Plan.

D. Commissioning Authority (CxA): The CxA works as the Owner's advocate and leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process. To minimize conflicts of interest, the CxA is hired directly by the Owner and is independent of the design or construction team.

E. Commissioning Plan: A document that outlines the scope, general project information, team organization, communication protocol, schedule, allocation of resources and documentation requirements for the commissioning process. This is an overall plan that provides the structure, schedule, and coordination planning for commissioning. The goal of the commissioning process is to ensure the proper efficient operation of the related MEP systems and completion of all punch list work items indicated in the Cx Issues Log Report on Day One prior to building occupancy for the commissioning objective. Refer to paragraph 3.1. As the project progresses, the CxA will update the plan, which includes details of:

1. Commissioning scope
2. General project info
3. Systems to be commissioned
4. Rigor of commissioning
5. Team contact information
6. Roles and responsibilities of all parties
7. Communication and reporting protocols
8. Commissioning overview and details of submittal activities
9. Construction observation, checklists, and start-up activities
10. Process for dealing with issues
11. Acceptance Phase Test procedure development and execution
12. Operation and maintenance (O&M) manual review
13. Operation training procedures
14. Systems manual development
15. Description of summary report, progress and reporting logs

F. Pre-functional Checklists (PFC's): Forms used by the contractor to verify that specified components and systems are correctly installed, ready for start-up and ready for functional testing. PFC's are independent of, and do not replace, any start-up forms that are required by the manufacturer. PFC's are frequently generated by the CxA, but may be contractor generated and reviewed by the CxA.

G. Start-Up: The process of energizing equipment for the purpose of demonstrating completeness of installation, utility connections, performance, system operations, and ability to perform for its specified purpose. Start-Up is accompanied by completion of PFC's and manufacturer's start-up documentation.

H. Functional Performance Tests (FPT's): Tests used by the commissioning team to help verify that components and systems function and perform according to the OPR and BOD. These are written based upon the engineer's sequences of operation and the approved Controls submittals. FPT's differ from other testing requirements found in the specifications, such as duct or pipe pressure testing, test & balance (TAB) or generator load bank testing. FPT's vary in level of complexity based upon the components and systems being tested and how critical they are within the project.

1.4 COMMISSIONING TEAM

A. Parties involved in the commissioning process that include the Owner, Owner's Representatives, End Users, Facilities Personnel, Design Professionals, Construction Team and Commissioning Authority.
   1. Owner
   2. Architect
   3. Engineer
   4. General Contractor & Sub-Contractors (Contractor)

PART 2 – PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. The commissioning objective focuses on documented confirmation that a facility fulfills the specified performance requirements for the building owner, occupants, and operators. To reach this objective, it is necessary to: clearly document the confirmation of the owner's project requirements (OPR) and basis of design (BOD), including performance and maintainability; and verify and document compliance with these criteria throughout construction, acceptance, and initial operation phases.

3.2 MEETINGS

A. Contractor shall budget time for periodic commissioning meetings to be attended by appropriate members of his construction team.

B. Commissioning Kick-Off Meeting to be coordinated with Contractor, Owner and Design Team to review Commissioning scope and process. Usually occurs when the Construction Team is mobilized and on-site. Attendance by one representative from each trade affected by the Cx process is required. Trades included, but not limited to: General Contractor, Mechanical Contractor, Electrical Contractor, Plumbing Contractor, Test & Balance Contractor and Controls Contractor. The KO meeting typically runs one to two hours.

C. Periodic Commissioning Meetings to review construction and acceptance phase commissioning activities and issues. Typically on-site and adjacent to an Owner-Architect-Contractor (OAC) meeting and/or a regularly scheduled site visit. Trades included, but not limited to: General Contractor, Mechanical Contractor, Electrical Contractor, Plumbing Contractor, Test & Balance Contractor and Controls Contractor. Meetings may be monthly during construction and more frequently during functional testing. Each usually lasts less than one hour.

3.3 DOCUMENTATION

A. Contractor shall provide the following completed documentation to the CxA:
   Pre-functional checklists.
   Equipment start-up reports.
   Duct pressure test reports.
   Pipe pressure test reports.
   Water quality reports.
   Sensor calibration reports.
   Test & Balance reports.
   Training agenda, attendance logs and owner acceptance of training.
   As-built documentation of commissioned systems.

B. CxA shall provide periodic site reports and Cx Issues Logs and issue to Owner, Design

Team and Contractor. Team members shall distribute as necessary to other parties for review and response.

3.4 RESPONSIBILITIES

A. Contractor

Construction, Acceptance and Training Phase

1. Facilitate the coordination of the commissioning work with the Construction Team.
2. Ensure that commissioning activities are being scheduled into the master schedule.
3. Furnish commissioning related documentation to the CxA.
4. Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.
5. Attend a commissioning kick-off meeting and other necessary meetings scheduled by the CxA to facilitate the Cx process.
6. Review Commissioning Plan and provide Construction Team contact information.
7. Coordinate the training of owner personnel.
8. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

B. Owner/Owner's Representative

Construction, Acceptance and Training Phase

1. Manage the contract of the A/E and of the General Contractor.
2. Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions.

C. Design Team

Construction, Acceptance and Training Phase

1. Manage the construction administration contract related to the Design Team and of the General Contractor.
2. Attend the commissioning kick-off meeting and selected commissioning team meetings.
3. Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual preparation, etc., as contracted.
4. Provide Basis of Design documentation updates.
5. Provide CxA with updates to design documents, ASI's and RFI's.
6. Coordinate resolution of system Issues identified during commissioning, according to the contract documents.
7. Prepare and submit final as-built design intent documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.

D. Commissioning Authority

General

1. Organize and lead the commissioning team. Coordinate with the Owner, Owner's Rep, Design Professionals and Contractor for commissioning activities with the construction schedule.
2. Convene commissioning team meetings.

Construction Phase

1. Develop and utilize a Commissioning (Cx) plan for the MEP systems indicating the Contractor's responsibilities for assisting in the commissioning process. This Cx Plan will be a living document throughout the Cx process and periodically updated as required based on the input of the Cx Team. The Cx Plan will be submitted for review by the Design Team, construction team and Owner. A final Cx Plan will be issued at the end of this phase.
2. Conduct a Commissioning Kick–Off meeting with general contractor, sub-

contractors, Owner and design team to review the Cx Plan and general Cx activities and procedures.

3. Review submittals and O&M manuals of equipment and systems to be commissioned.
4. Prepare installation Pre-functional equipment checklists for construction personnel use during the equipment installation process. NOTE: As an alternate, we will review the contractor generated PFC's for use on the project.
5. Prepare functional performance test procedures and submit to the design team and contractor for review and comment, edit as required and issue final test forms to the Cx Team for use in the Acceptance Phase.
6. Review and approve the Test and Balance Execution Plan.
7. Provide MEP site visits to verify installation of systems and components for proper maintenance access and equipment replacement and to document equipment and systems are ready for functional testing. These site observations shall review the installation per plans and specs of the Construction Documents. Cx site visits typically occur during these periods:
    a. Cx Kick-Off meeting.
    b. Periodic site visits for review of MEP installation.
    c. Before cover-up of underfloor/slab, in-wall or overhead.
    d. Equipment start-up.
    e. Test and Balance activities, including sensor calibration.
    f. Pressure testing of duct and pipe systems.
8. Confer with Contractor's superintendent at beginning of each site visit to review site conditions, general intent of visit and any personnel requirements. Recap site observations with Contractor and review any items requiring immediate attention.
9. Issue Commissioning Site Reports for site visits indicating general observations and any items of importance.
10. Update and distribute the Cx Issues Log based upon Cx site visits and any input from Cx team.
11. Coordinate with the Contractor's construction schedule for items to be commissioned and provide input for implementation of the Cx activities into the master construction schedule.

Acceptance Phase

1. Conduct MEP site visits to perform functional testing of the MEP systems.
2. Issue site reports and updated Cx Issues Logs.
3. Review system graphics, schedule and DDC point mapping. Point mapping may be a random sample.
4. Maintain a detailed log of testing of the equipment.

Training Phase

1. Review the Contractor's training agenda and materials prior to the training of the Owner's operating personnel by the contractor.
2. Obtain Owner accepted training logs for inclusion into the Cx documentation.

Report Phase

1. Submit Cx Summary Report, including the following:
    a. Executive Summary
    b. Commissioning Scope
    c. General Building Description
    d. MEP Systems Description
    e. Abbreviated Operating Instructions
    f. Summary of Issues Noted
    g. Suggested O&M
2. Provide Cx Manual, including the following:
    a. Cx Summary Report
    b. Documentation of OPR and BOD
    c. Final Cx Plan

d. Design and Construction information, including Construction Documents, Submittals, O&M and TAB Report.
e. Site Reports and Cx Issues Log
f. Copies of Pre-functional Checklists
g. Functional Test Forms, including blank forms for future testing.

END OF SECTION 01 91 13

SECTION 02 32 00 GEOTECHNICAL DATA

PART 1 – GENERAL

1.1 GEOTECHNICAL INVESTIGATION

A. Soil and Subsurface Investigations were conducted at the Site, the results of which are to be found in the following report:

Geotechnical Exploration – Elementary #38 for LCISD
Brookewater Boulevard and Wallingford Drive
Rosenberg, Texas
UES Project No. H241935

Prepared by: UES
Prepared date: October 23, 2024
Pages: 79 (PDF file)

B. Soil investigation data is provided only for the information and the convenience of the proposers. The Owner and Architect/Engineer disclaim any responsibility for the accuracy, true location and extent of the Soils Investigation that has been prepared by Others. They further disclaim responsibility for interpretation of that data by proposers, as in projecting soil-bearing values, rock profiles, soil stability and the presence, level and extent of underground water.

C. Proposers are urged to examine soils investigation data and to make their own investigation of the site before bidding.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 02 32 00

GEOTECHNICAL ENGINEERING REPORT

Elementary #38 for LCISD
Brookewater Boulevard and Wallingford Drive
Rosenberg, Texas
UES Project No. H241935
October 23, 2024

Prepared for:

Lamar Consolidated ISD
3911 Avenue I, Suite 214
Rosenberg, Texas 77471
Attention: Mr. J. Kevin McKeever

Prepared by:

100% CONSTRUCTION DOCUMENTS

Lamar Consolidated ISD
3911 Avenue I, Suite 214
Rosenberg, Texas 77471
Attention: Mr. J, Kevin McKeever

Re: Geotechnical Engineering Report
Elementary #38 for LCISD
Rosenberg, Texas
UES Project No. H241935

Dear Mr. J. Kevin McKeever:

UES Professional Solutions 44, LLC (hereinafter "UES") has performed a geotechnical exploration for the project referenced above. This geotechnical study was authorized through Purchase Order Number 73011569 dated July 02, 2024 and performed in accordance with UES Proposal No. 105555 dated June 24, 2024.

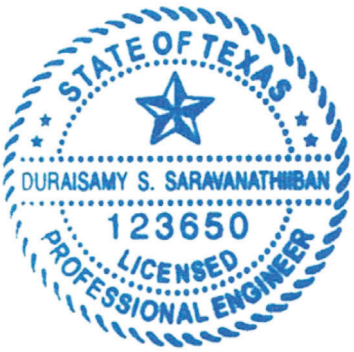
The results of this exploration, together with our recommendations, are presented in the accompanying report, an electronic copy of which is being transmitted herewith.

UES appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing materials testing services during construction, please contact our office.

Respectfully submitted,

UES Professional Solutions 44, LLC
TBPE Firm No. 813

Andres Mexquitic Jr.
Project Geologist



10/23/2024

Duraisamy S. (Roy) Saravanathiiban, Ph.D., P.E.
Geotechnical Department Manager

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APPENDICES

1.0 INTRODUCTION

Purpose and Scope. The purpose of this geotechnical study was to evaluate some of the physical and engineering properties of subsurface materials at selected locations on the subject site to develop geotechnical engineering design parameters and recommendations for the proposed project. To accomplish this, the scope of this study included field exploration consisting of drilling test borings and collecting samples of the subsurface materials, performing laboratory testing on selected samples obtained during the field exploration, performing engineering analysis and evaluation of the subsurface conditions with respect to the project characteristics, and development of foundation and pavement recommendations suitable for the proposed project. The scope of services did not include an environmental assessment of the site.

Project Description. The project consists of a proposed single-story, elementary school building with associated parking and driveways.

Project Location. The project is located about 0.48 miles southwest of Finney Vallet Road, approximately 0.5 miles from its intersection with Southwest Freeway in Rosenberg, Texas. The general location and orientation of the site are provided in Appendix A - Project Location Diagrams.

Loading Information. Structure loading information was not available at the time of this report. We have assumed the maximum foundation load for the structures will be less than 150 kips. ***Any change in the structural loads should be brought to our attention to review the design and assess the suitability of the recommendations provided.***

Site Grading Plan. The site grading plan was not available at the time of writing this report. Our recommendations provided herein are on the basis that cuts and fills of less than 2 foot will be required to bring the site to grade. **When the site grading plan is available, we should be notified and allowed to review the site grading plan to assess and modify our recommendations, as necessary.**

Cautionary Statement Regarding Use of this Report. As with any geotechnical engineering report, this report presents technical information and provides detailed technical recommendations for civil and structural engineering design and construction purposes. UES, by necessity, has assumed the user of this document possesses the technical acumen to understand and properly utilize the information and recommendations provided herein. UES strives to be clear in its presentation and, like the user, does not want potentially detrimental misinterpretation or misunderstanding of this report. Therefore, we encourage any user of this report with questions regarding its content to contact UES for clarification. Clarification will be provided verbally and/or issued by UES in the form of a report addendum, as appropriate.

Report Specificity. This report was prepared to meet the specific needs of the client for the specific project identified. Recommendations contained herein should not be applied to any other project at this site by the client or anyone else without the explicit approval of UES.

This Report is NOT a Specification. Recommendations in this report are not specifications. Geotechnical engineering requires significant experience and professional judgment. Conditions vary in the field which require and/or allow modification to recommendations provided herein at the discretion of the Geotechnical Engineer of Record.

2.0 FIELD EXPLORATION

Test Borings. The field exploration for this project included performing a total of 20 test borings as summarized in the table below. Depths referenced in this report and in the table below are measured from the existing ground surface at the respective boring location at time of the field exploration.

Boring Nos.	Depth, feet	Date Drilled	Location[2]
B-01 to B-10	25	07/29/2024, and 08/01/2024	Proposed School Building
B-11 to B20	5	08/02/2024	Proposed Parking, and Driveways.

UES determined the number, depth, and location of the test borings and performed the boring operations. The boring locations were not surveyed. Rather, UES personnel located the borings in the field using a recreational hand-held GPS unit and therefore should be considered approximate. The approximate boring locations are provided in Appendix B - Boring Location Diagram.

The test borings were advanced between sample intervals and to the termination depth of the borings using a drilling rig equipped with a rotary head turning continuous flight augers and using air-rotary drilling methods.

Boring Logs. Boring logs generated during this study are included in Appendix C - Boring Logs and Laboratory Results.

Cohesive Soil Sampling. Cohesive soil samples were generally obtained using Shelby tube samplers in general accordance with American Society for Testing and Materials (ASTM) D1587. The Shelby tube sampler consists of a thin-walled steel tube with a sharp cutting edge connected to a head equipped with a ball valve threaded for rod connection. The tube is pushed into the undisturbed soils by the hydraulic pulldown of the drilling rig. The soil specimens were extruded from the tube in the field, logged, tested for consistency using a hand penetrometer, sealed, and packaged to maintain "in situ" moisture content.

Consistency of Cohesive Soils. The consistency of cohesive soil samples was evaluated in the field using a calibrated hand penetrometer. In this test a 0.25-inch diameter piston is pushed into the undisturbed sample at a constant rate to a depth of 0.25-inch. The results of these tests are tabulated at the respective sample depths on the boring logs. When the capacity of the penetrometer is exceeded, the value is tabulated as 4.5+.

Granular Soil Sampling. Granular soil samples were generally obtained using split-barrel sampling procedures in general accordance with ASTM D1586. In the split-barrel procedure, a disturbed sample is obtained in a standard 2-inch outside diameter (OD) split barrel sampling spoon driven 18 inches into the ground using a 140-pound (lb) hammer falling freely 30 inches. The number of blows for the last 12 inches of a standard 18-inch penetration is recorded as the Standard Penetration Test resistance (N-value). The N-values are recorded on the boring logs at the depth of sampling. Samples were sealed and returned to our laboratory for further examination and testing.

Groundwater Observations. The test borings were performed using dry drilling techniques, which enabled the potential detection of groundwater during the drilling and sampling procedures and prior to backfilling and plugging the boreholes. Groundwater observations are shown in Appendix C – Boring Logs.

Borehole Backfilling and Plugging. Upon completion of the borings, the boreholes were backfilled with onsite soil cuttings from the top and plugged at the surface.

3.0 LABORATORY TESTING

UES performs visual classification and any of several laboratory tests, as appropriate, to define pertinent engineering characteristics of the soils encountered. Tests are performed in general accordance with ASTM or other standards and the results included at the respective sample depths on the boring logs or separately tabulated, as appropriate, and included in Appendix C - Boring Logs and Laboratory Results. Laboratory tests and procedures routinely utilized, as appropriate, for geotechnical studies are tabulated in the following table.

Test Procedure	Description
ASTM D1140	Standard Test Methods for Amount of Material in Soils Finer than the No. 200 (75-µm) Sieve
ASTM D2166	Standard Test Method for Unconfined Compressive Strength of Cohesive Soil
ASTM D2216	Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2217	Standard Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

Test Procedure	Description
ASTM D2487	Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2488	Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
ASTM D4220	Standard Practices for Preserving and Transporting Soil Samples
ASTM D4318	Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D4546	Standard Test Methods for One-Dimensional Swell or Settlement Potential of Cohesive Soils
ASTM D4643	Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM D4647	Standard Test Method for Identification and Classification of Dispersive Clay Soils by the Pinhole Test
ASTM D4718	Standard Practice for Correction of Unit Weight and Water Content for Soils Containing Oversize Particles

4.0 SITE CONDITIONS

4.1 General

Review of Aerial Photographs. Historical aerial photographs of the site were reviewed for potential past alterations to the site which could impact geotechnical design conditions. Specifically, aerial photographs were reviewed to visually assess obvious areas of significant past fill on site. Aerial photographs reviewed for this study are identified in the following table and are included in Appendix D - Aerial Photographs.

Aerial Photographs Reviewed	
Year	Observations Since Prior Aerial Photograph
1995	The site was undeveloped, a pond was noted on the northeast side of the site, and a well was noted to the southeast end of the site.
2002	No visible changes were noted.
2004	No visible changes were noted.
2006	No visible changes were noted.
2008	The pond was backfilled
2012	No visible changes were noted.
2014	A rough graded path was noted traversing the site southeast to northeast across the site.
2019	No visible changes were noted.
2021	No visible changes were noted.
2022	No visible changes were noted.
2024	Earthwork activities were noted across the site.

Site Fills Based on Areial Photographs. Aerial photographs indicate that the site potentially used as agricultural land. In addition to an existing pond was present within the project site and backfilled in the past. Also, an existing well was noted and removed within the site.

Therefore, we would expect surficial disturbance of site soils. **Existing fill and previous existed pond backfill recommendations are provided in section 5.7**

Limitations. Due to the intermittent nature and relatively low resolution of aerial photographs, as well as our lack of detailed information regarding the past land use of the site, our review should not be interpreted as eliminating the possibility of cuts and/or fills on site which could detrimentally affect future construction.

Topography. A United States Geological Survey (USGS) topographic map of the site is provided in Appendix E - USGS Topographic Map. The map indicates the site is relatively flat.

Site Photographs. Representative photographs of the site at the time of this study are provided in "Appendix F - Site Photographs". Photographed conditions are consistent with the aerial photographs and topographic map.

4.2 Geology

Geologic Formation. Based on available surface geology maps and our experience, it appears this site is located in the Beaumont Formation, areas predominantly clay. A geologic atlas and USGS formation description are provided in "Appendix G - Geologic Information". Soils within the Beaumont Formation, areas predominantly clay can generally be characterized as clay, silt, and sand.

4.3 Soil Conditions

Stratigraphy. Descriptions of the various strata and their approximate depths and thickness per the Unified Soil Classification System (USCS) are provided on the boring logs included in "Appendix C - Boring Logs and Laboratory Results". Terms and symbols used in the USCS are presented in "Appendix H - Unified Soil Classification System". A summary of the stratigraphy indicated by the borings is provided in the following table.

Generalized Subsurface Conditions at Proposed School Building Location (Boring B-01 to B-10)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	**2**	**FILL**	**Hard LEAN CLAY (CL) FILL , Soft SANDY FAT CLAY (CH) FILL, Stiff FAT CLAY (CH) FILL, Stiff to hard FAT CLAY WITH SAND (CH) FILL, SILTY SAND (SM).** **Note:** • **SILTY SAND (SM) encountered in boring B-08 at 0' to 2'.**
2	25	PREDOMINANTLY FAT CLAY with some SAND, and LEAN CLAY	Very stiff to hard LEAN CLAY (CL), Stiff to hard FAT CLAY (CH), Stiff to hard FAT CLAY WITH SAND (CH), SANDY FAT CLAY (CH), Dense to Medium Dense SILTY SAND (SM), Medium Dense SANDY SILT (ML). **Note:** **SILTY SAND (SM) encountered in boring B-01, and B-07 to B-09 at 23' to 25'.**
Note: 1. Boring Termination Depth = 20 feet bgs.			

Generalized Subsurface Conditions at Proposed Paving Locations (Borings B-11 to B-20)			
Nominal Depth, feet bgs (Except as Noted)		General Description	Detailed Description of Soils/Materials Encountered
Top of Layer	Bottom of Layer		
0	**2**	**FILL**	**SILTY SAND (SM), Stiff to hard FAT CLAY WITH SAND (CH), Stiff FAT CLAY (CH), Stiff LEAN CLAY (CL).** **Note:** **5 feet of fill was encountered in borings B-14 and B-15.**
2	5	PREDOMINANTLY FAT CLAY with some LEAN CLAY	Stiff to hard FAT CLAY (CH), Hard LEAN CLAY (CL).
Note: 1. Boring Termination Depth = 20 feet bgs.			

Swell Tests. Swell tests were performed on selected clay soil samples. Swell test details are provided in "Appendix C - Boring Logs and Laboratory Results".

4.4 Groundwater

Groundwater Levels. The test borings were advanced using continuous flight augers and air-rotary drilling methods, with intermittent sampling methods. These dry drilling techniques enable observation of potential groundwater seepage levels. Groundwater levels encountered in the borings during this study are identified in the table below. Depths referenced in this report and in the table below are measured from the existing ground surface at the respective boring location at time of the field exploration.

Boring No.	Depth Groundwater Initially Encountered (feet)	Groundwater Depth Upon Completion of Drilling (feet)
B-01 to B-20	Not Encountered	Not Encountered

Long-term Groundwater Monitoring. These groundwater observations are indicative of the groundwater conditions present at the time the borings were drilled. The amount of water in an open borehole largely depends on the permeability of the soils encountered at the boring location. In relatively impervious soils, such as clayey soils, a suitable estimate of the groundwater depth may not be possible, even after several days of observation. Long-term monitoring of groundwater conditions via piezometers or groundwater monitoring wells was not performed during this study and was beyond the scope of this study. Long-term monitoring can reveal groundwater levels materially different than those encountered during measurements taken while drilling the borings.

Groundwater Fluctuations. It is difficult to accurately predict the magnitude of subsurface water fluctuations that might occur based upon short-term observations. Future construction activities may alter the surface and subsurface drainage characteristics of this site. Seasonal variations, temperature, land-use, proximity to water bodies, and recent rainfall conditions may influence the depth to the groundwater. With these considerations UES recommends that the contractor verifies the groundwater elevation before construction starts.

5.0 ANALYSIS AND RECOMMENDATIONS

5.1 Seismic Site Classification

The Site Class assigned for seismic design considers various factors, such as the soil profile (whether it's soil or rock), shear wave velocity, and strength, averaged over a depth of 100 feet. As our borings didn't reach depths of 100 feet, we made determinations under the assumption that the subsurface materials beneath the borehole bottoms resembled those encountered at the termination depth. Following the guidelines outlined in Section 1613.3.2 of the 2018 International Building Code and Table 20.3-1 in the 2010 ASCE-7, we recommend utilizing Site Class D for seismic design purposes at this location.

5.2 Potential Vertical Rise (PVR)

Maintaining a consistent moisture content in the soil is the key to minimizing both heave and shrinkage related structural problems. Therefore, building maintenance and control of water are paramount in the performance of a slab-on-grade and shallow foundations.

PVR or Equivalent Calculations. The PVR or its equivalent can be estimated several ways. UES utilizes the TxDOT method, swell tests, and a Volflo analysis to provide the best possible understanding of expected PVR and its variability.

Calculated PVR. Considering the subsurface conditions encountered at this site and methods used to estimate the potential vertical rise of the soil, floor slabs and other soil-supported elements could experience soil-related movements of up to about 4½ inches if constructed at the grades discussed in Section 1.0.

These potential seasonal movements were estimated in general accordance with methods outlined by Texas Department of Transportation (TxDOT) Test Method Tex-124-E, the results of swell tests, a Volflo analysis and engineering judgment and experience. Estimated movements were calculated assuming the moisture content of the in-situ soil within the normal zone of seasonal moisture content change varies between a "dry" condition and a "wet" condition as defined by Tex-124-E. Also, it was assumed a 1 psi surcharge load from the floor slab acts on the subgrade soils. Movements exceeding those predicted could occur if positive drainage of surface water is not maintained or if soils are subject to an outside water source, such as leakage from a utility line or subsurface moisture migration from off-site locations.

5.3 Construction Excavations

Applicability. Recommendations in this section apply to short-term construction-related excavations for this project.

The contractor is responsible for designing any excavation slopes, temporary sheeting or shoring. Design of these structures should include any imposed surface surcharges. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods and sequencing of construction operations. The contractor should also be aware that slope height, slope inclination or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state and/or federal safety regulations, such as OSHA Health and Safety Standard for Excavations, 29 CFR Part 1926, or successor regulations.

Stockpiles should be placed well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation. Surface drainage

should be carefully controlled to prevent flow of water over the slopes and/or into the excavations. Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulging at the toe. If potential stability problems are observed, a geotechnical engineer should be contacted immediately. Shoring, bracing or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Texas.

5.4 Groundwater Control

Groundwater was not encountered during the subsurface study. However, seasonal fluctuations and/or unforeseen environmental conditions may result in water being encountered at shallower depths. This groundwater could be encountered in excavations required for building pad preparation. We therefore recommend the Contractor provide a line item for dewatering in the bid package in case dewatering is required. Test pits should be performed prior to construction to verify groundwater conditions.

Typically, the Contractor is responsible for designing, installing and maintaining a dewatering system for groundwater control and taking precautions to avoid distress to nearby existing structures, as a result of dewatering. Dewatering systems should be designed, installed and monitored by personnel qualified and experienced with dewatering soils. We recommend the Contractor consider retaining a dewatering expert to assist in identifying, implementing and monitoring the most suitable and cost-effective method to control groundwater. The following is intended to provide guidance to the Contractor for dewatering systems.

In cohesive soils where seepage is usually low, groundwater is generally managed by collection in trench bottom sumps for pumped disposal. Care should be taken to have a redundant pumping system that allows for overnight pumping. Water must not be allowed to pond in the excavation bottoms. The softening of soils can lead to instability and sloughing of trench side walls. Clay soils interbedded with and/or underlain by lenses or layers of granular soils may have to be dewatered using techniques for cohesionless soils.

In saturated cohesionless soils, groundwater is typically controlled by the installation of vacuum well points. Close well point spacing (typically on the order of 5 to 15 ft) is generally required if the granular soils are significant silt or clay content. The practical maximum depth for using vacuum well points is considered to be about 15 ft. When groundwater control is required below 15 ft, deep wells with down-hole submersible pumps have generally proved successful.

Generally, the groundwater depth should be lowered to a depth of at least 3 ft below the planned excavation bottom to provide a firm working surface. Extended and/or extensive dewatering can result in settlement of existing structures in the vicinity; the Contractor is to take necessary precautions to monitor and minimize the effects on these structures.

5.5 Earthwork

5.5.1 Site Preparation

In the area of improvements, all concrete, trees, stumps, brush, debris, septic tanks, abandoned structures, roots, vegetation, rubbish, and any other undesirable matter should be removed and properly disposed. All vegetation should be removed, and the exposed surface should be scarified to an additional depth of at least 6 inches. It is the intent of these recommendations to provide a loose surface with no features that would tend to prevent uniform compaction by the equipment to be used.

5.5.2 Proofroll

Building pad, playground and paving subgrades should be proofrolled with a fully loaded tandem axle dump truck or similar pneumatic-tire equipment to locate areas of loose subgrade. In areas to be cut, the proofroll should be performed after the final grade is established. In areas to be filled, the proofroll should be performed prior to fill placement. Areas of loose or soft subgrade encountered in the proofroll should be removed and replaced with engineered fill, moisture conditioned (dried or wetted, as needed) and compacted in place.

5.5.3 Construction Considerations

Surface Sandy/Silty Soils. **The sandy/silty soils encountered at and near the ground surface at this site are very susceptible to changes in moisture. The presence of surface water due to precipitation or groundwater may result in a decrease in the ability to compact and work with the soil. It is common for these soils to pump when subjected to high levels of moisture. In addition, these soils located at and near the ground surface will allow surface water to infiltrate until the water becomes perched on a less permeable layer at depth. As such, construction difficulties should be anticipated, especially during the wet season or immediately after rain events. Although having a thin layer of non-plastic or low plasticity soils overlying cohesive soils is typical of this geologic region, our experience suggests that the local contractors find these materials troublesome and can often be the source of change orders, construction delays, and budget over runs. Soils of this type are especially prone to requiring the implementation of wet weather/soft subgrade recommendations provided in this report.**

Maintenance of Subgrade during Construction. While the exposed subgrade is expected to remain relatively stable initially, unstable conditions may arise during general construction activities, particularly if the soil is exposed to wet weather conditions and repetitive construction traffic. The use of lighter construction equipment can help minimize disturbance to the subgrade. In the event of unstable conditions, stabilization measures will be necessary.

After grading is completed, it's crucial to maintain the moisture content of the subgrade before proceeding with pavement construction. Minimizing construction traffic over the finished subgrade is advisable. If the subgrade becomes frozen, desiccated, saturated, or disturbed, the affected material should either be removed or treated by scarification, moisture conditioning, and recompaction before pavement construction begins. UES should be retained to observe earthwork and to perform necessary tests and observations during subgrade preparation.

5.5.4 Grading and Drainage

Every attempt should be made to limit the extreme wetting or drying of the subsurface soils because swelling and shrinkage of these soils will result. Standard construction practices of providing good surface water drainage should be used. A positive slope of the ground away from any foundation should be provided. Ditches or swales should be provided to carry the run-off water both during and after construction. Stormwater runoff should be collected by gutters and downspouts and should discharge away from the buildings.

Root systems from trees and shrubs can draw a substantial amount of water from the clay soils at this site, causing the clays to dry and shrink. This could cause settlement beneath grade-supported slabs such as floors, walks and paving. Trees and large bushes should be located a distance equal to at least one-half their anticipated mature height away from grade slabs.

Lawn areas should be watered moderately, without allowing the clay soils to become too dry or too wet.

5.5.5 Wet Weather/Soft Subgrade

Soft and/or wet surface soils may be encountered during construction, especially following periods of wet weather. Wet or soft surface soils can present difficulties for compaction and other construction equipment. If specified compaction cannot be achieved due to soft or wet surface soils, one of the following corrective measures will be required:

1. Removal of the wet and/or soft soil and replacement with select fill,
2. Chemical treatment of the wet and/or soft soil to improve the subgrade stability, or
3. If allowed by the schedule, drying by natural means.

Chemical treatment is usually the most effective way to improve soft and/or wet surface soils. UES should be contacted for additional recommendations if chemical treatment is planned due to wet and/or soft soils.

5.5.6 Fill

Select Fill. ***Any fill placed in building pad should consist of select fill***. Select fill should consist of soil with a liquid limit less than 35 and a Plasticity Index between 8 and 20. The select fill should be placed in loose lifts not exceeding 8-inches and should be compacted to at least 95 percent maximum dry density (per ASTM D-698) and at a moisture content between optimum and 4 percent above optimum moisture content. The subgrade to receive select fill should be scarified to a depth of 6 inches and compacted to at least 95 percent of the material's maximum standard Proctor dry density (ASTM D-698) at a workable moisture level at least 2 percentage points above optimum.

Lime-treated Native Clay Soil. Based on the laboratory testing conducted for this study, the native clay on-site soils will not meet requirements for select fill outlined in the section titled "Fill". As an alternative to importing select fill, the native clay soil may be blended with lime to reduce the plasticity index to meet select fill requirements. Based on our experience, we expect that it will require between 6- and 8-percent lime (by dry unit weight) to reduce the plasticity index of the native clay soils to select fill requirements. Prior to selecting this alternative, lime series tests should be performed to assess the amount of lime required.

General Fill. General fill may be placed in improved areas outside of building pad areas, swimming pool areas and any PVR sensitive play structure pads. General fill should consist of material approved by the Geotechnical Engineer with a liquid limit less than 50. General fill should be placed in loose lifts not exceeding 8-inches and should be uniformly compacted to a minimum of 95 percent maximum dry density (per ASTM D-698) at a moisture content between optimum and 4 percent above optimum moisture content.

Fill Restrictions. Select fill and general fill should consist of those materials meeting the requirements stated. Select fill and general fill should not contain material greater than 4-inches in any direction, debris, vegetation, waste material, environmentally contaminated material, or any other unsuitable material.

Unsuitable Materials. Materials considered unsuitable for use as select fill or general fill include low and high plasticity silt (ML and MH), silty clay (CL-ML), organic clay and silt (OH and OL) and highly organic soils such as peat (Pt). These soils may be used for site grading and restoration in unimproved areas as approved by the Geotechnical Engineer. Soil placed in unimproved areas should be placed in loose lifts not exceeding 10-inches and should be compacted to at least 92 percent maximum dry density (per ASTM D-698) and at a moisture content within ±4 percentage points of optimum.

Cautionary Note. It is extremely important that select fill placed within building pads be properly characterized using one or more representative proctor samples. The use of a proctor sample which does not adequately represent the select fill being placed can lead to erroneous compaction (moisture and density) results which can significantly increase the

potential for swelling of the select fill. The plasticity index of select fill soils placed during construction should be checked every day to confirm conformance to the project requirements and consistency with the proctor being utilized.

5.5.7 Testing

Required Testing and Inspections. Field compaction and classification tests should be performed by UES. Compaction tests should be performed in each lift of the compacted material. We recommend the following minimum soil compaction testing be performed: one test per lift per 2,500 square feet (SF) in the area of the building pad, one test per lift per 5,000 SF outside the building pad, and one test per lift per 100 linear feet of utility backfill. If the materials fail to meet the density or moisture content specified, the course should be reworked as necessary to obtain the specified compaction. Classification confirmation inspection/testing should be performed daily on select fill materials (whether on-site or imported) to confirm consistency with the project requirements. The testing frequency recommended herein can be altered (increased or decreased) at the discretion of the geotechnical engineer of record.

Liability Limitations. Since proper field inspection and testing are critical to the design recommendations provided herein, UES cannot assume responsibility or liability for recommendations provided in this report if construction inspection and/or testing is performed by another party.

5.6 Demolition Considerations

Applicability. Recommendations in this section apply to the removal of any existing foundations, utilities or pavement which may be present on this site.

General. Special care should be taken in the demolition and removal of existing floor slabs, foundations, utilities, and pavements to minimize disturbance of the subgrade. Excessive disturbance of the subgrade resulting from demolition activities can have serious detrimental effects on planned foundation and paving elements.

Existing Foundations. Existing foundations are typically slabs, shallow footings, or drilled piers. If slab or shallow footings are encountered, they should be completely removed. If drilled piers are encountered, they should be cut off at an elevation at least 24-inches below proposed grade beams or the final subgrade elevation, whichever is deeper. The remainder of the drilled pier should remain in place. Foundation elements to remain in place should be surveyed and superimposed on the proposed development plans to determine the potential for obstructions to the planned construction. UES should be contacted if drilled piers are to be excavated and removed completely. Additional earthwork activities will be required to make the site suitable for new construction if the piers are to be removed completely.

Existing Utilities. Existing utilities and bedding to be abandoned should be completely removed. Existing utilities and bedding may be abandoned in place if they do not interfere with planned development. Utilities which are abandoned in place should be properly pressure-grouted to completely fill the utility.

Backfill. Excavations resulting from the excavation of existing foundations and utilities should be backfilled in accordance with Section 5.5.6 - Fill.

Other Buried Structures. Other types of buried structures (wells, cisterns, etc.) could be located on the site. If encountered, UES should be contacted to address these types of structures on a case-by-case basis.

5.7 Existing Fill and Previously Existed Pond Backfill

During the subsurface investigation, existing fill was encountered at various boring locations, with depths ranging from about 2 to 5 feet below exiting grade within the site. It is worth noting that existing fill may also be present, potentially at greater depths, in other parts of the site. Accurately delineating fill soils, especially those resembling native soils, based on discrete test boreholes is challenging. As such, the recorded fill depths should be considered as estimates and may slightly deviate from the actual fill depths.

Although not encountered in the borings for this project, uncontrolled fills may contain trash, debris, concrete rubble, construction debris, boulders, and other unsuitable materials. Excavation and grading contracts should include provision for removal of unsuitable materials from the project site.

Based on the aerial photographs and our subsurface investigation, we understand that the southeast portion of the proposed building will be located within the previously existed pond. Before placing backfill in the pond/low-lying areas, it's imperative to completely remove sediments and soft soil from the sides and bottom of the existing pond/low lying areas until reaching the surface of undisturbed competent native soil. As a minimum, the excavation should extend at least one foot below the bottom of the loose soils or sediments and at least 2 ft beyond the perimeter of the pond or low-lying area. Furthermore, the exposed undisturbed competent native soil after excavating the pond/low-lying areas should undergo proof rolling using a fully loaded tandem axle truck to ensure a suitable working surface, as per Section 5.5.2. Following successful proof-rolling, the pond can be backfilled according to our recommendations outlined in Section 5.5.6- Fill. A UES representative must be present to oversee the preparation of the pond bottom, including excavation, proof rolling, and backfilling.

If there is no record indicating that the fill was placed and compacted in a controlled manner (engineered fill), it will be necessary excavate and recompact it in accordance with select fill placement requirements (see Section 5.5.6) prior to construction of the building pads. Any existing fill within the proposed paving area may remain in-place provided the proofroll (see section 5.5.2) is passed.

5.8 Foundation System

Appropriate Foundation Types. The following foundation types are appropriate to the site based on the geotechnical conditions encountered:

- School Building - Underreamed drilled piers or Shallow footings.

Foundation Determination. We have assumed that structural loads will be typical for the type and size of building proposed. Recommendations for the foundation types are presented below. Final determination of the foundation type to be utilized for this project should be made by the Structural Engineer based on loading, economic factors, and risk tolerance.

Avoidance of Mixing Foundation Types. Mixing of foundation types for a given building should be avoided. Where mixing of slab/shallow footings and underreamed drilled piers is required for a given building, we should be contacted to review the foundation plans prepared by the Structural Engineer prior to construction. Slab/shallow footing foundations and underreamed drilled pier foundations can have incompatible movement characteristics.

Foundations Adjacent to Slopes. Foundations placed too close to adjacent slopes steeper than 5H:1V may experience reduced bearing capacities and/or excessive settlement. Recommendations provided herein assume foundations are not close enough to adjacent slopes in excess of 5H:1V to be detrimentally affected. Therefore, foundations closer than 5 times the depth of adjacent slopes, pits, or excavations in excess of 5H:1V should be brought to our attention in order that we may review the appropriateness of our recommendations.

Assumed Maximum Cut/Fill Depth. The site grading plan was unavailable at the time of writing of this report. Therefore, we have assumed that cut/fill of less than 2-foot will be required to bring the site to grade. In the event cut/fill in the building pad exceed 2-foot, we should be notified and allowed to review the design to assess the suitability of the foundation recommendations provided. ***UES must be allowed to review the finalized grading plan to assess the appropriateness of our recommendations.***

Foundation Plans Review. We recommend contacting our office to review the foundation plans, details and related structural loads, prior to finalizing the design to check conformance with the recommendations presented herein.

5.8.1 Underreamed Drilled Piers

General. Underreamed drilled pier foundations bearing in native soil may be utilized at this site for the proposed structure.

Note: Sandy soils and clay soils with layers of sand seams were encountered in many of the borings. ***Test piers should be performed prior to construction outside the foundation area to verify constructability of the underreams.*** If underream collapse occurs during test pier drilling, we should be contacted for further recommendations. Some field adjustments in the depth of the underreamed piers may still be required in some areas to maintain the bottom of the piers above any possible groundwater seepage and caving soils encountered near the bearing depth. Adjustments in the depths of the piers should be approved and observed in the field by UES personnel.

Foundation Depth. We recommend that underreamed piers should bear in competent undisturbed native soil at a depth of 12-feet below the existing grade.

Bearing Capacity. The piers may be proportioned using a net dead load plus sustained live load bearing pressure of 3,500 psf or a net total load pressure of 5,250 psf, whichever condition results in a larger bearing surface. These bearing pressures are based on a safety factor of 3 and 2, respectively, against shear failure of the foundation bearing soils.

Settlement. Settlement of underreamed drilled pier foundations is influenced by several factors, including load (pressure), soil consolidation properties, depth to groundwater, geometry (width and length), depth, spacing, and quality of construction. Although a detailed settlement analysis is beyond the scope of this study, soil related settlement for foundations, 8-feet in diameter or less, constructed as described above should be about 1 inch or less. We should be allowed to review piers greater than 8-feet in diameter to assess their settlement. However, pier foundation settlement is heavily affected by construction quality and, as a result, oftentimes exceeds 1 inch. Our settlement estimate assumes that proper construction practices are followed and there are no overlapping stresses due to adjacent piers. To mitigate any overlapping stresses due to adjacent piers, we recommend a minimum clear spacing of one bell diameter (larger bell diameter) between adjacent piers.

Lateral Capacity. Because of the potential for the upper two feet of the soil to shrink and pull away from drilled piers during dry periods, we recommend soil resistance to lateral loads on drilled piers be ignored in the upper 2-feet of the soil profile. For resistance of lateral loads on drilled piers, we recommend the following LPILE design parameters.

Depth (feet) [1]	Soil Type	Effective Soil Unit Weight (pcf) [2]	Allowable Cohesion, c (psf) [3]	Angle of Internal Friction, ϕ (degrees)	Strain at ½ Peak Strength, ε_{50}	Soil Modulus Parameter, k (for lateral loads) (pci)
0 - 2	Clay/Sand	120	-	-	NA	NA
2 - 12	Clay	120	700	0	0.007	300

Notes:
1. Depth below existing grade.
2. Effective soil unit weight based on assumed groundwater depth greater than 12-feet.
3. Factor of safety 3 is included in the recommended cohesion parameter.

Uplift. Each pier should contain full length reinforcing steel and should be designed to resist the uplift pressure (soil-to-pier adhesion) due to potential soil swell along the shaft from post-construction heave and other uplift forces applied by structural loadings. The magnitude of uplift adhesion due to soil swell along the pier shaft cannot be defined accurately and can vary according to the actual in-place moisture content of the soils during construction. It is estimated this uplift adhesion will not exceed about 2,000 psf. This soil adhesion is approximated to act uniformly over the upper 8 ft of the pier shaft in contact with clayey soils.

Uplift Resistance. The uplift force due to swelling of active clays should be resisted by the underreamed portion of the pier. The underreamed portion should be at least two (2) and not exceeding 3 times the diameter of the shaft. The minimum clear spacing between edges of adjacent piers should be at least one (1) underream diameter, based on the larger underream.

Shaft/Diameter Ratio. The piers should be provided with an underream diameter to shaft diameter ratio of not less than 2 to 1 and not greater than 3 to 1. **There is an inherent risk of bell collapse during construction. Unforeseen sand and silt pockets/seams and/or laminated/slickensided structures in clays or variable groundwater conditions can cause significant loss of tensile strength resulting in bell collapse. Therefore, UES recommends test piers with underreams be constructed prior to finalizing the foundation design to assess the risk of bell collapse**.

Grade Beams. Grade beams may be used to support loads by spanning the drilled-and-underreamed piers. Grade beams should be designed to transfer loads to the piers as a simply supported beam, ignoring any support from the soil between the piers. The depth of exterior and interior grade beams can be varied according to the structural requirements of the floor slab. However, we recommend that exterior grade beams extend at least 12 inches below the lowest adjacent grade. Additionally, backfill soils placed adjacent to grade beams must be compacted as outlined in Section 5.5.6 of this report.

In general, where the subgrade is improved and the floor slab is supported on-grade, we do not recommend the use of void boxes below grade beams and caps because of the potential to collect free water within the void space, especially if replacing the excavated subgrade soils with relatively pervious select fill materials. **If a suspended floor slab is utilized, a void space of 10 inches should be provided beneath grade beams and caps.**

Pier Spacing. For uplift considerations, piers should not be spaced closer than two underream diameters (edge to edge) based on the diameter of the larger underream. Closer pier spacings may result in reduced uplift capacity. We should be contacted to review closer pier spacings on a case-by-case basis.

Construction Observation. The construction of all piers should be observed as a means to verify compliance with design assumptions and to verify:

1. the bearing stratum;
2. underream size;
3. the removal of all smear zones and cuttings;
4. that groundwater seepage, when encountered, is correctly handled; and
5. that the shafts are vertical (within acceptable tolerance).

We should be contacted for further evaluation and recommendations if soils other than those anticipated to be encountered at the design foundation bearing level, or if groundwater seepage and/or underream collapse occurs.

Groundwater. Groundwater was not encountered during the subsurface study. However, groundwater may be encountered during pier excavation and the risk of groundwater seepage is increased during or after periods of precipitation. Submersible pumps may be capable of controlling seepage in the pier excavation to allow for concrete placement.

Applicable TxDOT Standards. Drilled pier foundations should be constructed in accordance with the requirements of TxDOT Item 416 (standard specification for construction of drilled pier foundations).

Concrete Placement. Concrete should be placed in the shafts immediately after excavation to reduce the risk of significant groundwater seepage, deterioration of the foundation-bearing surface and underream collapse. Concrete should have a slump of 5 to 7 inches and should not be allowed to strike the shaft sidewall or steel reinforcement during placement.

5.8.2 Shallow Footings – Alternative

General Requirement. Shallow strip and spread footing foundations may be used for support of the proposed elementary school building if recommendations in Sections 5.7 - Existing Fill and 5.8.3- Subgrade Improvement and Slab-on-Grade are followed.

Foundation Depth. Shallow strip and spread footing foundations should bear on native soil or select fill at a minimum depth of 2-feet below the surrounding grade. Shallow strip and spread footings should not bear on moisture conditioned soil.

Bearing Capacity. Footings bearing in compacted select fill soils can be designed using a net allowable soil bearing pressure of 2,500 psf. In using net pressures, the weight of the footing and backfill over the footing, including the weight of the floor slab need not be considered. Hence, only loads applied at/or above the finished floor need to be used for dimensioning footings.

Geometry. Individual spread footings should be at least 30 inches wide and continuous strip footing foundations should be at least 16 inches wide.

Settlement. Settlement of footing foundations is influenced by several factors, including load (pressure), soil consolidation properties, depth to groundwater, geometry (width and length), depth, spacing, and quality of construction. Although a detailed settlement analysis is beyond the scope of this study, settlement for foundations, with a maximum horizontal dimension of 10-feet, constructed as described above should be about 1 inch. Differential movements between individual footings can approach total movements. We should be allowed to review foundations larger than 10-feet to assess their settlement. Our settlement estimate assumes that proper construction practices are followed and there are no overlapping stresses due to adjacent footings. To mitigate any overlapping stresses due to adjacent footings, we recommend a minimum clear spacing of one footing width (width of larger footing) between adjacent footings.

Lateral Resistance. Resistance to lateral loads may be provided by the soil adjacent to the footings. We recommend using an equivalent fluid weight of 180 pcf for lateral resistance. A coefficient of sliding friction of 0.25 between the concrete footings and underlying soil may be combined with the passive resistance. Appropriate safety factor should be utilized by the structural engineer for lateral stability of the shallow footings. Lateral resistance should be neglected within 2 ft of final grade.

Construction and Observation. The geotechnical engineer should monitor foundation construction to verify conditions are as anticipated and that the materials encountered are suitable for support of foundations. Soft or unsuitable soils encountered at the foundation bearing level should be removed to expose suitable, firm soil. Foundation excavations should be dry and free of loose material. Excavations for foundations should be filled with concrete

before the end of the workday or sooner if necessary to prevent deterioration of the bearing surface. Prolonged exposure or inundation of the bearing surface with water will result in changes in strength and compressibility characteristics. If delays occur, the excavation should be deepened as necessary and cleaned, in order to provide a fresh bearing surface. If more than 24 hours of exposure of the bearing surface is anticipated in the excavation, a "mud slab" should be used to protect the bearing surfaces. If a mud slab is used, the foundation excavations should initially be over-excavated by approximately 4 inches and a lean concrete mud slab of approximately 4 inches in thickness should be placed in the bottom of the excavation immediately following exposure of the bearing surface by excavation. The mud slab will protect the bearing surface, maintain more uniform moisture in the subgrade, facilitate dewatering of excavations if required and provide a working surface for the placement of formwork and reinforcing steel.

5.8.3 Subgrade Improvement and Slab-on-Grade

Assumed Maximum Cut/Fill Depth. The site grading plan was unavailable at the time of writing of this report. Therefore, we have assumed that cut/fill of less than 2-foot will be required to bring the site to grade. In the event cut/fill in the building pad exceed 2-foot, we should be notified and allowed to review the design to assess the suitability of the foundation recommendations provided. ***UES must be allowed to review the finalized grading plan to assess the appropriateness of our recommendations.***

Potential Vertical Slab Movements. Based on the information gathered during this study, a slab constructed on-grade will be subject to potential vertical slab movements of about 4 ½ - inches.

Subgrade Treatment Using Select Fill. The depth of subgrade treatment is dependent on desired post-construction PVR. The following table presents recommended depth of subgrade treatment to reduce the post-construction PVR to 1-inch.

Subgrade Treatment - Select Fill Option		
PVR (inches)	Minimum Thickness of Select Fill Soil (feet, bgs) [1]	Thickness of Compacted Subgrade below Select Fill (inches) [2]
1	5	6

Notes:
1. Depth measured below bottom of the slab-on-grade,
2. The subgrade to receive select fill soil should be scarified to a depth indicated above. The scarified subgrade should be compacted to at least 95 percent of the material's maximum standard Proctor dry density (ASTM D-698) at a workable moisture level at least 2 percentage points above optimum and placed in loose lifts not exceeding 8 inches.

Subgrade treatment should extend at least 5-feet horizontally beyond the perimeter of the building, at least 2 ft beyond the perimeter of the shallow footings and any PVR sensitive structures.

Subgrade Treatment at Exterior Doorways. Subgrade treatment should extend beneath sidewalk areas that abut exterior doorways to the building. Failure to perform subgrade treatment in these areas can increase the probability of differential heaving between exterior sidewalks and doorways, resulting in exterior doors that will not or have difficulty opening outward due to "sticking" caused by heaving sidewalk slabs. Sidewalks tied to pavements and other flatworks that extend beyond the subgrades treated for PVR reduction may be subjected to movements similar to those experienced for untreated subgrades.

Subgrade Moisture. The slab subgrade is prone to drying after being exposed and should be kept moist prior to slab placement.

Moisture Barrier. A moisture barrier should be used beneath the slab foundation in areas where floor coverings will be utilized (such as, but not limited to, wood flooring, tile, linoleum, and carpeting).

Fill Related Slab Settlement. Fill will settle under its own weight. A properly constructed fill will generally settle up to 2% of the fill thickness due to its own weight and independent of external loads. That settlement begins as soon as lift placement begins. The time required for settlement to occur is a function of soil type, pore water, and drainage path conditions and therefore can vary widely. As a result, fill-related settlement should be expected before AND after construction of the slab. Slab movement related to settling fill can be reduced by allowing as much time as possible between the time the fill is placed and construction of the slab. Furthermore, we recommend survey monitoring of constructed fills be performed to verify the rate and magnitude of settlement has been reduced to an acceptable level prior to construction of slabs on the fill.

Load Related Slab Settlement. Slabs on grade will settle when subjected to load. Slab settlement is a function of soil type, load intensity, load geometry, and other factors. Upon request by the Structural Engineer for this project, settlement estimates will be provided for the specific loading application in question.

Movement Risk. Recommendations have been provided to mitigate the effects of soil movement. Some soil movement and related structural cracking and floor unevenness should be expected even after following recommendations in this report. The elimination of risk related to soil movement is typically not feasible. We would be happy to discuss other, more expensive, movement-related risk mitigation alternatives upon request.

5.8.4 Structural Floor Slab

In lieu of the construction of a slab-on-grade which requires select fill to reduce the PVR to about 1 inch or less, a structural floor slab supported on piers installed as previously described may be utilized. If a structural floor slab is to be installed, a minimum 10-inch void space

between the bottom of the slab or grade beams and the underlying ground surface should be maintained.

5.9 Pavement

General. Recommendations for rigid pavement and preparation of the pavement subgrade are provided in the following sections. A traffic study indicating the number and type of vehicles on which to base the pavement design was not provided. Therefore, our recommendations are based upon our experience with similar projects assuming normal vehicular loading.

Civil and Drainage Consideration. **Pavement design is the responsibility of the project Civil Engineer.** We have recommended preliminary pavement sections based on geotechnical information and assumed traffic information in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Guidelines for Design of Pavement Structures dated 1993. According to AASHTO design methodology, the pavement design thickness considers pavement performance, traffic, subgrade soils, pavement materials, environment, drainage, and reliability. The applicability of our assumptions should be reviewed and approved by the project Civil Engineer before the pavement section is finalized. The recommended pavement sections assume good drainage quality prevails over the life of the pavement and that the pavement subgrade is exposed to moisture levels approaching saturation less than 25 percent of the time. Good drainage is defined by AASHTO as "the ability to remove water from the pavement within one (1) day". Therefore, it is critical that the project Civil Engineer provide appropriate pavement drainage design to assure validity of the assumed drainage conditions.

5.9.1 Rigid Pavement

Portland cement concrete (PCC) with a minimum 28-day compressive strength of 3,500 pounds per square inch (psi) should be utilized for rigid pavement. Grade 60 reinforcing steel should be utilized in the transverse and longitudinal directions. The following pavement thicknesses and reinforcing are recommended:

Paving Use	Thickness (inches)	Reinforcing
Parking Areas for Automobiles and Light Trucks	5	No. 3 bars spaced on 22-inch intervals
Fire Lane, Bus Lane and Drive Lanes and Areas Subjected to Light to Medium Trucks	6	No. 3 bars spaced on 18-inch intervals
Areas Receiving Heavy Trucks and Dumpsters	7	No. 3 bars spaced on 16-inch intervals
Notes: 1. Recommended pavement reinforcement is in accordance with ACI guidelines. 2. Pavement subgrade should be chemically stabilized per Section 5.9.2.		

Alternate Pavement Thickness. Concrete pavement thicknesses provided above can be increased an extra 1 inch (corresponding reinforcing requirements must be changed) as a substitution for stabilization of the pavement subgrade, provided a passing proof-roll is achieved prior to placement of reinforcing steel at the pavement subgrade areas.

Pavement Joints. Contraction joints should be spaced at about 25 times the pavement thickness up to a maximum of 15 feet in any direction. Saw cut control joints should be cut within 6 to 12 hours of concrete placement. ACI recommendations indicate that regularly spaced expansion joints may be deleted from concrete pavements. Therefore, the installation of expansion joints is optional and should be evaluated by the Civil Engineer. Dowels should have a diameter equal to $^1/_8$ the slab thickness, be spaced on 12-inch intervals, and be embedded at least 9 inches. Appropriate joint sealant is recommended to keep water from saturating the pavement subgrade and to prevent the introduction of incompressible material into the joints. Routine monitoring and maintenance of joint sealants are recommended. Where not specified herein, concrete pavement should comply with Texas Department of Transportation (TxDOT) Standard Specifications, Item 360, "Concrete Pavement", or local equivalent.

5.9.2 Pavement Subgrade

Potential Vertical Soil Movements. We have assumed that site treatment as recommended in Section 5.8.3- Subgrade Improvement and Slab-on-Grade will not be performed within the pavement areas for this project. As a result, pavements will be subjected to the calculated PVR for this site. Based on the information gathered during this study, a pavement constructed on-grade will be subject to potential vertical movements of up to about 4 ½ -inches. Because heave is generally associated with a source of water, it can occur differentially. Edge lift, excessive cracking, corner breaks, and poor ride quality are just a few of the many examples of pavement issues that can occur when in-situ PVR values are high. We should be contacted to provide PVR mitigation strategies to help reduce potential movements if desired. Strategies available for reducing potential soil movements include soil stabilization with lime or cement, removal of the on-site expansive soils and replacement with select fill.

Subgrade Preparation. Fat clay or silty sand are expected to be encountered or exposed at pavement subgrade. The pavement subgrade should be placed in loose lifts not exceeding 8-inches and should be uniformly compacted to a minimum of 95 percent maximum dry density (per ASTM D-698) and within ±2 percent of the optimum moisture content. We recommend the subgrade be stabilized using the following:

For Clayey Soils (PI>15)		
Reagent	Application Rate (pounds per square yard)	Application Depth (inches)
Lime	36	6

Lime stabilization should be performed in accordance with TxDOT Standard Specifications, Item 260, "Lime Stabilized Subgrade", or local equivalent.

For Sandy Soils(PI<15)		
Reagent	Application Rate (pounds per square yard)	Application Depth (inches)
Portland Cement	20	6
80% Flyash/20% Lime Blend	50	6

Cement stabilization should be performed in accordance with TxDOT Standard Specifications, Item 275, "Portland Cement Treated Materials" or local equivalent, and lime-fly ash stabilization should be performed in accordance with TxDOT Standard Specifications, Item 265, "Lime-Fly Ash Treatment of Materials Used as Subgrade" or local equivalent.

Cautionary Note Regarding Stabilized Subgrades. Stabilized subgrades are not suitable for supporting heavy construction traffic. Stabilized subgrades that have been subjected to heavy construction traffic should be re-inspected and re-stabilized as necessary prior to the construction of overlying pavement.

6.0 Limitations

Professional services provided in this geotechnical exploration were performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater. UES, upon written request, can be retained to provide these services.

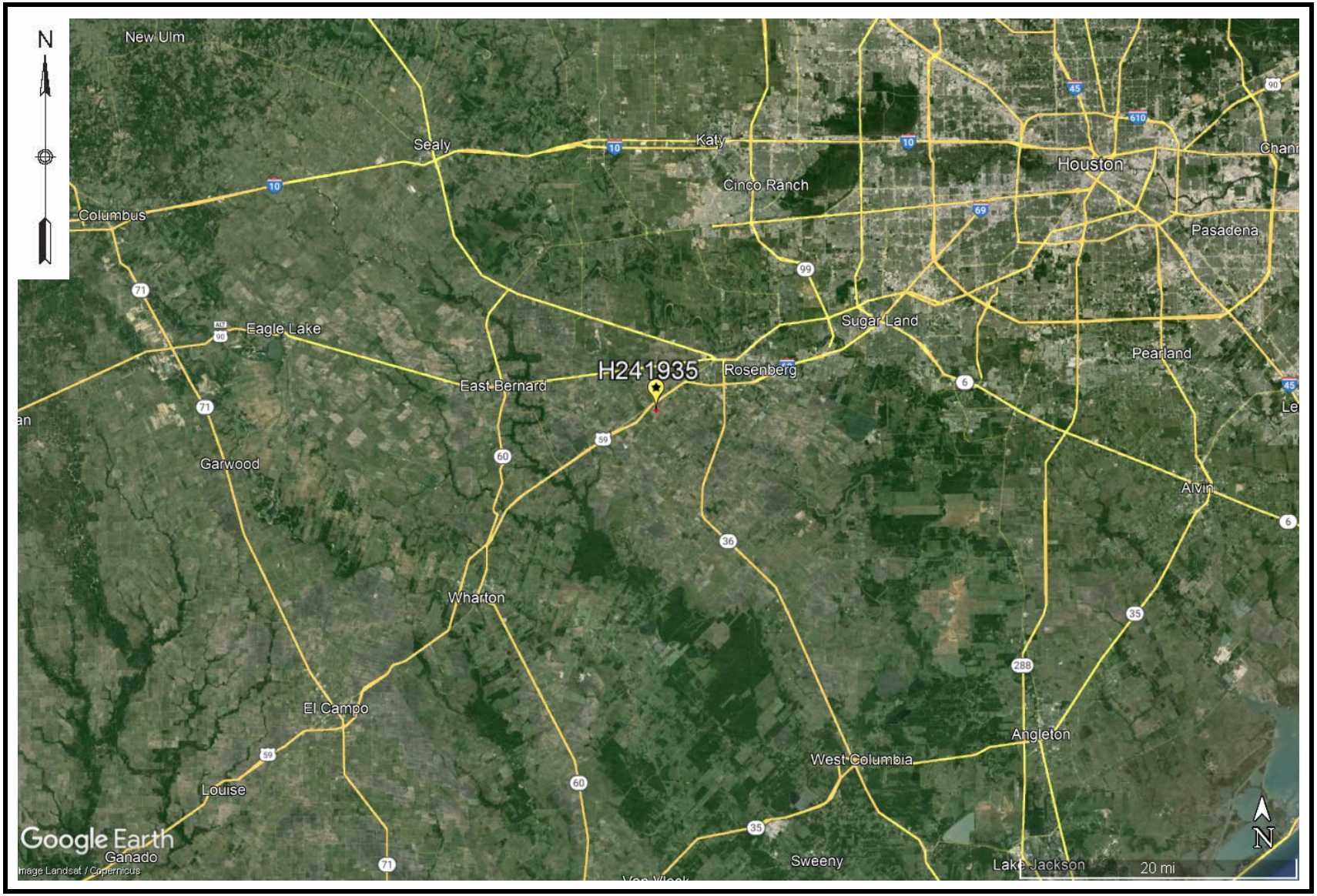
UES is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for the exclusive use of the Client (and their designated design representatives), and is related solely to design of the specific structures outlined in Section 1.0. No party other than the Client (and their designated design representatives) shall use or rely upon this report in any manner whatsoever unless such party shall have obtained UES's written acceptance of such intended use. Any such third party using this report after obtaining UES's written acceptance shall be bound by the limitations and limitations of liability contained herein, including UES's liability being limited to the fee paid to it for this report. Recommendations presented in this report should not be used for design

of any other structures except those specifically described in this report. In all areas of this report in which UES may provide additional services if requested to do so in writing, it is presumed that such requests have not been made if not evidenced by a written document accepted by UES. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than one (1) year after completion of this report. Non-compliance with any of these requirements by the Client or anyone else shall release UES from any liability resulting from the use of, or reliance upon, this report.

Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, our office should be contacted immediately since this may materially alter the recommendations. Further, UES is not responsible for damages resulting from workmanship of designers or contractors. It is recommended the Owner retain qualified personnel, such as a Geotechnical Engineering firm, to verify construction is performed in accordance with plans and specifications.

Appendix A - Project Location Diagrams

PROJECT LOCATION DIAGRAM - GENERAL



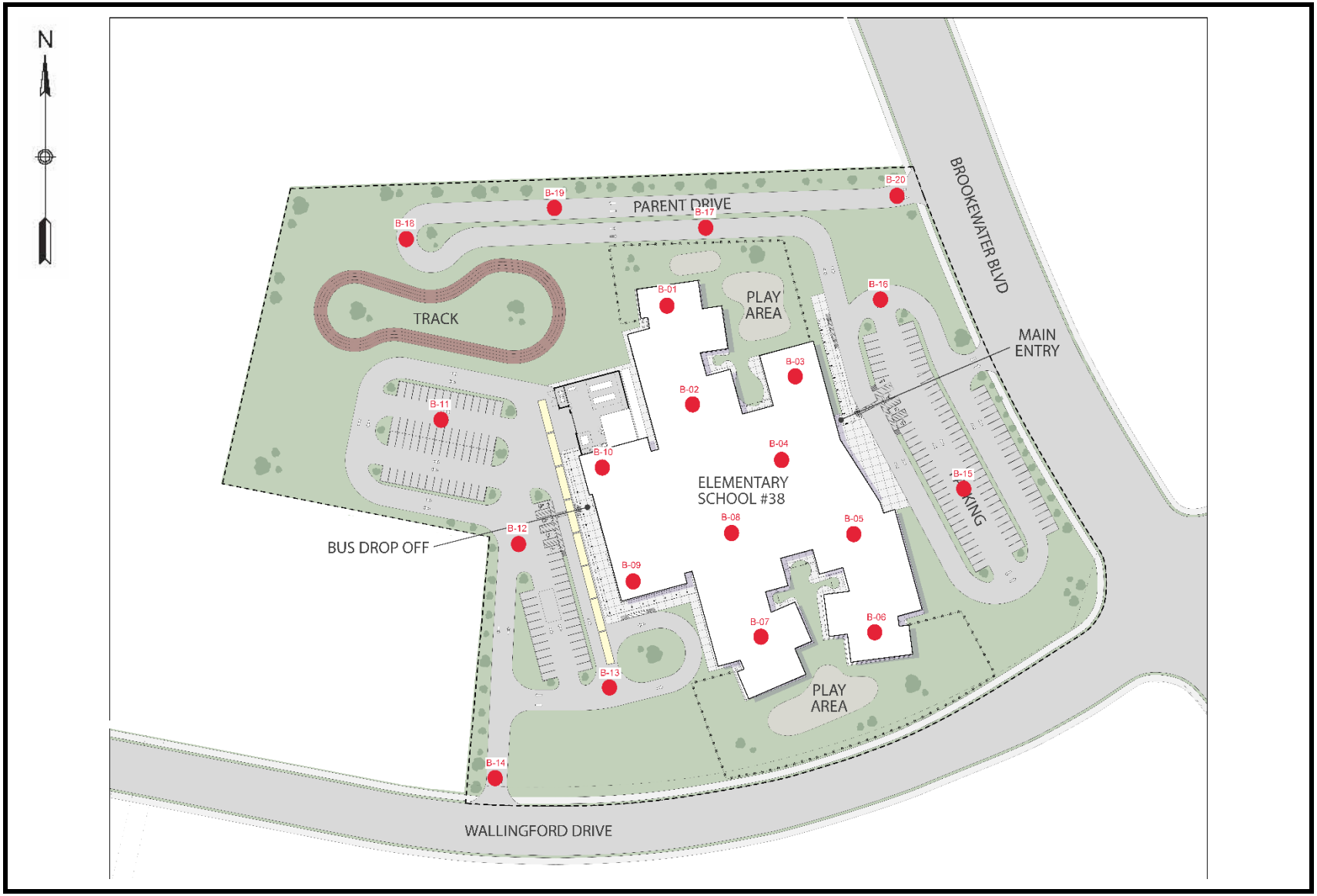
UES Project No. H241935

Elementary #38 for LCISD

PROJECT LOCATION DIAGRAM - LOCAL

Appendix B - Boring Location Diagram

BORING LOCATION DIAGRAM



UES Project No. H241935

Elementary #38 for LCISD

Appendix C - Boring Logs and Laboratory Results

UES Professional Solutions 44, LLC
15811 Tuckerton Road, Houston, TX 77095
Telephone: 713-360-0460; Fax: 713-360-0481

BORING NUMBER B-01

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 7/29/24 **COMPLETED** 7/29/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		LEAN CLAY (CL) FILL - Hard, dark gray, brown, brownish yellow with calcareous nodules.	ST			4.50+					13	39	15	25	
		LEAN CLAY (CL) - Very stiff to hard, dark gray.	ST			4.50+					15				
5			ST			4.50					20				
		FAT CLAY (CH) - Very stiff, gray, dark gray.	ST			4.00					22	81	24	57	86
		Light gray, brownish yellow, reddish brown with sand seams.	ST			4.00					26				
10															
		FAT CLAY WITH SAND (CH) - Hard, reddish brown, light gray.	ST			4.50+					19				
15															
			ST			4.50+					25				
20															
		SILTY SAND (SM) - Medium dense, light brown.	SS		4-7-9 (16)						2				
25		Bottom of hole at 25.0 feet.													

TEST ONLY 2 H241935.GPJ NEW GINT TEMP.GDT 8/9/24

UES Professional Solutions 44, LLC
15811 Tuckerton Road, Houston, TX 77095
Telephone: 713-360-0460; Fax: 713-360-0481

BORING NUMBER B-02

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 7/29/24 **COMPLETED** 7/29/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SANDY FAT CLAY (CH) FILL - Soft, gray, light gray, light brown with sand fissures.	ST			0.50					21				
		FAT CLAY (CH) - Stiff to hard, dark gray, gray.	ST			3.00					22				
5			ST			4.50					20	85	25	60	83
		Light gray, gray from 6 to 8 feet.	ST			4.50+					20				
		Light gray, brownish yellow, reddihs brown with calcareous nodules from 8 to 13 feet.	ST			4.50					22				
10															
		FAT CLAY WITH SAND (CH) - Hard, reddish brown, light gray.	ST			4.50+					20				
15															
		With sand and silt seams from 18 to 23 feet.	ST			4.50+		2.9	16	110	18				
20															
		FAT CLAY (CH) - Hard, reddish brown, light gray.	ST			4.50+					24				
25		Bottom of hole at 25.0 feet.													

TEST ONLY 2 H241935.GPJ NEW GINT TEMP.GDT 8/9/24

UES Professional Solutions 44, LLC
15811 Tuckerton Road, Houston, TX 77095
Telephone: 713-360-0460; Fax: 713-360-0481

BORING NUMBER B-03

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 7/29/24 **COMPLETED** 7/29/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Very stiff, brown, light gray, reddish brown, brownish yellow with sand seams.	ST			3.50					15				
		FAT CLAY (CH) - Stiff to hard, dark gray.	ST			3.50					20	71	22	49	
5		Gray from 4 to 6 feet.	ST			2.50					22				
		Light gray from 6 to 8 feet.	ST			3.00					24				
10		Light gray, brownish yellow with calcareous deposits from 8 to 13 feet.	ST			3.50		2.0		110	18				
15		Reddish brown, light gray from 13 to 25 feet. With sand seams from 13 to 18 feet.	ST			3.50					14				
20			ST			4.50					23				
25		With sand seams from 23 to 25 feet.	ST			4.50+					20				
		Bottom of hole at 25.0 feet.													

TEST ONLY 2 H241935.GPJ NEW GINT TEMP.GDT 8/9/24

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BORING NUMBER B-04

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 7/29/24 **COMPLETED** 7/29/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Hard, dark gray, light gray, reddish brown with sand seams.	ST			4.50+					15				
		FAT CLAY (CH) - Stiff to hard, gray, light gray.	ST			4.00		3.6		108	20				
5			ST			3.50					21				
		Light gray, gray from 6 to 8 feet.	ST			4.00					21	77	23	54	86
		Light gray, reddish brown, brownish yellow with calcareous nodules from 8 to 13 feet.	ST			4.50+					20				
10															
		Reddish brown, light gray from 13 to 25 feet. With calcareous nodules from 13 to 18 feet.	ST			4.50+					19				
15															
		With sand seams from 18 to 25 feet.	ST			3.00					16				
20															
			ST			4.50+					21				
25		Bottom of hole at 25.0 feet.													

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BORING NUMBER B-05

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 7/29/24 **COMPLETED** 7/29/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Stiff, dark gray, gray, light brown with sand seams.	ST			3.00					20				
		FAT CLAY (CH) - Very stiff to hard, dark gray, gray.	ST			3.50					20				
5			ST			3.50					21	73	24	49	
		Light gray, gray with calcareous nodules from 6 to 8 feet.	ST			4.50+					21				
		FAT CLAY WITH SAND (CH) - Very stiff to hard, reddish brown.	ST			4.50+					20				
10															
		Reddish brown, light gray from 13 to 23 feet.	ST			4.50+					20				
15															
			ST			4.50					25				
20															
		SANDY FAT CLAY (CH) - Firm, reddish brown, with sand seams.	ST			1.50					20				
25		Bottom of hole at 25.0 feet.													

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BORING NUMBER B-06

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 7/29/24 **COMPLETED** 7/29/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY (CH) FILL - Stiff, dark gray, gray, reddish brown.	ST			2.50					24				
		FAT CLAY (CH) - Stiff to hard, dark gray.	ST			2.50		1.7		101	23				
5		Dark gray, light gray from 4 to 6 feet. With calareous nodules from 4 to 13 feet.	ST			3.00					20				
		Light gray, gray, brownish yellow, reddish brown from 6 to 8 feet.	ST			3.50					20				
		Reddish brown, light gray from 8 to 23 feet.	ST			3.50					22	56	18	38	96
10															
			ST			4.50+					23				
15															
			ST			4.50+					28				
20															
		SANDY FAT CLAY (CH) - Stiff, reddish brown with sand seams.	ST			3.00		1.6	20	110	20				
25		Bottom of hole at 25.0 feet.													

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BORING NUMBER B-07

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/1/24 **COMPLETED** 8/1/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Stiff, dark gray, light gray, reddish brown with sand seams and root fibers.	ST			3.00					25	59	19	40	
		FAT CLAY (CH) - Stiff to hard, gray, light gray.	ST			2.50					22				
5			ST			2.50					23				
			ST			4.00					22				
		Light brown, reddish brown with seams from 8 to 13 feet. With calacreous nodules from 8 to 18 feet	ST			4.00					22	59	19	40	94
10															
			ST			4.50+					22				
15															
		SANDY LEAN CLAY (CL) - Stiff, reddish brown, light brown, light gray, with sand seams and layers, and laminated layers.	ST			2.00					18				
20															
		SANDY SILT (ML) - Medium dense, reddish brown.	SS		10-12-18 (30)						10				
25		Bottom of hole at 25.0 feet.													

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BORING NUMBER B-08

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/1/24 **COMPLETED** 8/1/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SILTY SAND (SM) FILL - Light brown, brown.	AU								18				
		FAT CLAY (CH) - Very stiff, dark gray, gray.	ST			3.00		1.8		101	21				
5			ST			4.50					20	54	20	35	
			ST			4.00					22				
		Light gray, gray from 8 to 13 feet.	ST			4.00		3.8		100	22				
10															
		Reddish brown, light gray from 13 to 23 feet. With sand seams and calcareous nodules from 13 to 18 feet.	ST			4.50					24				
15															
			ST			4.50					27				
20															
		SANDY SILT (ML) - Medium dense, reddish brown.	SS		9-10-16 (26)						11				
25		Bottom of hole at 25.0 feet.													

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BORING NUMBER B-09

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/1/24 **COMPLETED** 8/1/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Stiff, dark gray, light brown with sand seams.	ST			2.00					24				
		FAT CLAY WITH SAND (CH) - Stiff to hard, dark gray, gray.	ST			3.00					26	55	19	36	81
5			ST			4.50					22				
		Light gray with ferrous nodules from 6 to 8 feet.	ST			4.50					19				
		Light gray, brownish yellow, reddish brown from 8 to 13 feet.	ST			4.00					23				
10															
		Reddish brown, light gray from 13 to 23 feet.	ST			4.50+					21				
15															
		With calcareous nodules from 18 to 23 feet.	ST			4.50					22				
20															
		SILTY SAND (SM) - Medium dense, light brown.	SS		10-13-17 (30)						3				
25		Bottom of hole at 25.0 feet.													

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BORING NUMBER B-10

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/1/24 **COMPLETED** 8/1/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Very stiff, dark gray, light gray, reddish brown with sand seams.	ST			3.50					22				
		FAT CLAY (CH) - Stiff to hard, dark gray, gray.	ST			2.50					24				
5			ST			2.50					25				
			ST			3.50					24	66	22	44	
		Gray, light gray from 8 to 13 feet. With calcareous nodules from 8 to 23 feet.	ST			2.50					25				
10															
		Reddish brown, light gray from 13 to 23 feet.	ST			4.50+					24				
15															
			ST			4.50		2.9	16	108	20				
20															
		SILTY SAND (SM) - Dense, light brown.	SS		13-15-20 (35)						2				
25		Bottom of hole at 25.0 feet.													

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BORING NUMBER B-11

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SILTY SAND (SM) FILL - Light brown, gray with clay pockets.	AU								16				8
		FAT CLAY (CH) - Stiff to very stiff, dark gray, gray. With calcareous nodules from 2 to 4 feet.	ST			3.00					22				
5			ST			4.00					19				
		Bottom of hole at 5.0 feet.													

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BORING NUMBER B-12

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
												LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0		FAT CLAY WITH SAND (CH) FILL - Very stiff, dark gray, reddish brown.	ST			4.00					18				
		FAT CLAY (CH) - Stiff to very stiff, dark gray.	ST			2.50					26	64	21	43	
5			ST			4.00					21				
		Bottom of hole at 5.0 feet.													

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BORING NUMBER B-13

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		LEAN CLAY WITH SAND (CL) FILL - Stiff, dark gray, reddish brown.	ST			3.00					23	43	16	27	
		FAT CLAY (CH) - Stiff to very stiff, dark gray.	ST			2.50					25				
5			ST			4.50					21				
		Bottom of hole at 5.0 feet.													

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BORING NUMBER B-14

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Stiff to hard, gray, dark gray, reddish brown with sand seams.	ST			2.00					23				
		Light gray, gray, reddish brown.	ST			4.50+					18	60	20	40	85
5		SILTY SAND (SM) FILL - Light brown, reddish brown with clay pockets.	AU								16				
		Bottom of hole at 5.0 feet.													

TEST ONLY 2 H241935.GPJ NEW GINT TEMP.GDT 8/9/24

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BORING NUMBER B-15

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY (CH) FILL - Stiff, light gay, dark gray, reddish brown.	ST			2.50					18	54	19	35	
		Light gray, gray from 2 to 4 feet.	ST			2.25					22				
5		Dark gray from 4 to 5 feet.	ST			2.75					23				
		Bottom of hole at 5.0 feet.													

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BORING NUMBER B-16

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY WITH SAND (CH) FILL - Stiff, gray, light gray, reddish brown.	ST			1.75					21				
		LEAN CLAY (CL) - Hard, dark gray.	ST			4.50+					15	48	17	31	
5			ST			4.50+					15				
		Bottom of hole at 5.0 feet.													

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BORING NUMBER B-17

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SILTY SAND (SM) FILL - Light brown, brown.	AU								19				35
		FAT CLAY (CH) - Stiff to very stiff, dark gray.	ST			2.50					28				
5			ST			4.00					24				
		Bottom of hole at 5.0 feet.													

UES Professional Solutions 44, LLC
15811 Tuckerton Road, Houston, TX 77095
Telephone: 713-360-0460; Fax: 713-360-0481

BORING NUMBER B-18

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY (CH) FILL - Stiff, reddish brown, light gray.	ST			2.50					28				
		FAT CLAY (CH) Stiff to hard, light gray, gray.	ST			4.50+					20	61	19	43	
5		Wtih calcareous nodules from 4 to 5 feet.	ST			2.00					22				
		Bottom of hole at 5.0 feet.													

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15811 Tuckerton Road, Houston, TX 77095
Telephone: 713-360-0460; Fax: 713-360-0481

BORING NUMBER B-19

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		FAT CLAY (CH) FILL - Stiff, reddish brown, gray.	ST			2.50					19	60	22	38	
		FAT CLAY (CH) - Very stiff to hard, dark gray.	ST			4.00					20				
5			ST			4.50+					19				
		Bottom of hole at 5.0 feet.													

UES Professional Solutions 44, LLC
15811 Tuckerton Road, Houston, TX 77095
Telephone: 713-360-0460; Fax: 713-360-0481

BORING NUMBER B-20

CLIENT Lamar Consolidated ISD
PROJECT NAME Elementary #38 for LCISD
PROJECT NUMBER H241935
PROJECT LOCATION Rosenberg, Texas
DATE STARTED 8/2/24 **COMPLETED** 8/2/24
GROUND ELEVATION _____ **NORTHING** _____
CONTRACTOR UES
GROUND WATER LEVELS: **EASTING** _____
METHOD Auger 0 - 25 feet
INITIALLY ENCOUNTERED Not Encountered
LOGGED BY A.P. **CHECKED BY** A.M.
AFTER 15 MIN. Not Measured
NOTES _____
AFTER ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	TORVANE (tsf)	Compressive Strength (tsf)	Confining Pressure (psi)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		SILTY SAND (SM) FILL - Light brown, gray, reddish brown with clay pockets.	AU								14				
		FAT CLAY WITH SAND (CH) - Stiff to hard, dark gray.	ST			2.25					22	56	19	37	83
5			ST			4.50+					18				
		Bottom of hole at 5.0 feet.													

ABSORPTION SWELL TEST (ASTM D4546) RESULTS			
Boring No.	B-03	B-06	B-09
Average Sample Depth (ft)	3	9	3
Sample Height (in)	1	1	1
Sample Diameter (in)	2.5	2.5	2.5
Initial Sample Volume (cu in)	4.91	4.91	4.91
Initial Sample Weight (gr)	157.7	166.3	153.7
Initial Moisture (%)	21	19	25
Final Moisture (%)	24	21	25
Initial Wet Unit Weight (pcf)	122	129	119
Initial Dry Unit Weight (pcf)	101	108	96
Applied Over Burden (psi)	2.6	7.8	2.6
Initial Dial Reading (in)	0.0000	0.0000	0.0000
Final Dial Reading (in)	0.0040	0.0040	0.0060
Swell (%)	0.40	0.40	0.60

Appendix D - Aerial Photographs

AERIAL PHOTOGRAPH - 2024

UES Project No. H241935

Elementary #38 for LCISD

AERIAL PHOTOGRAPH - 2022

UES Project No. H241935

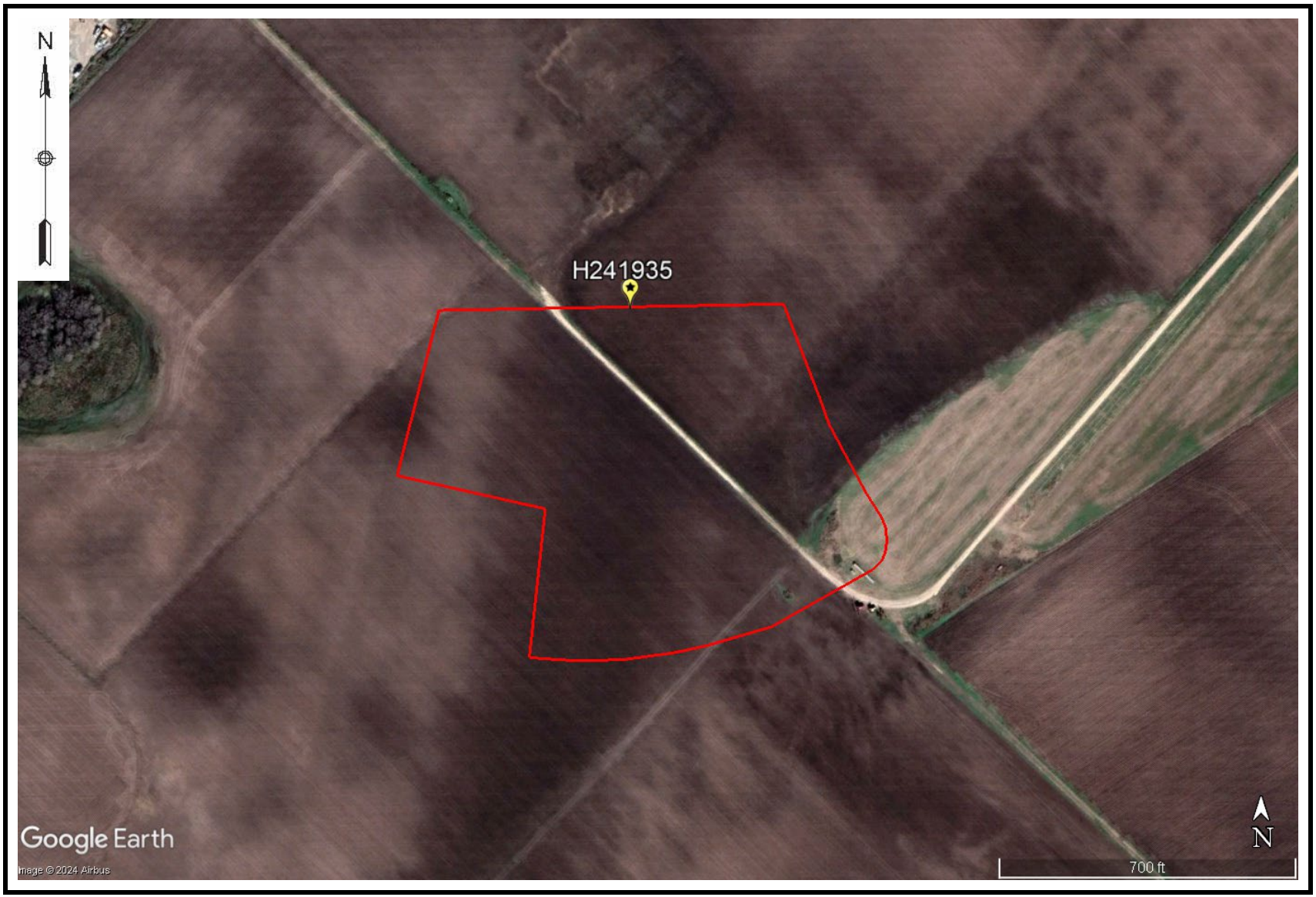
Elementary #38 for LCISD

AERIAL PHOTOGRAPH - 2021

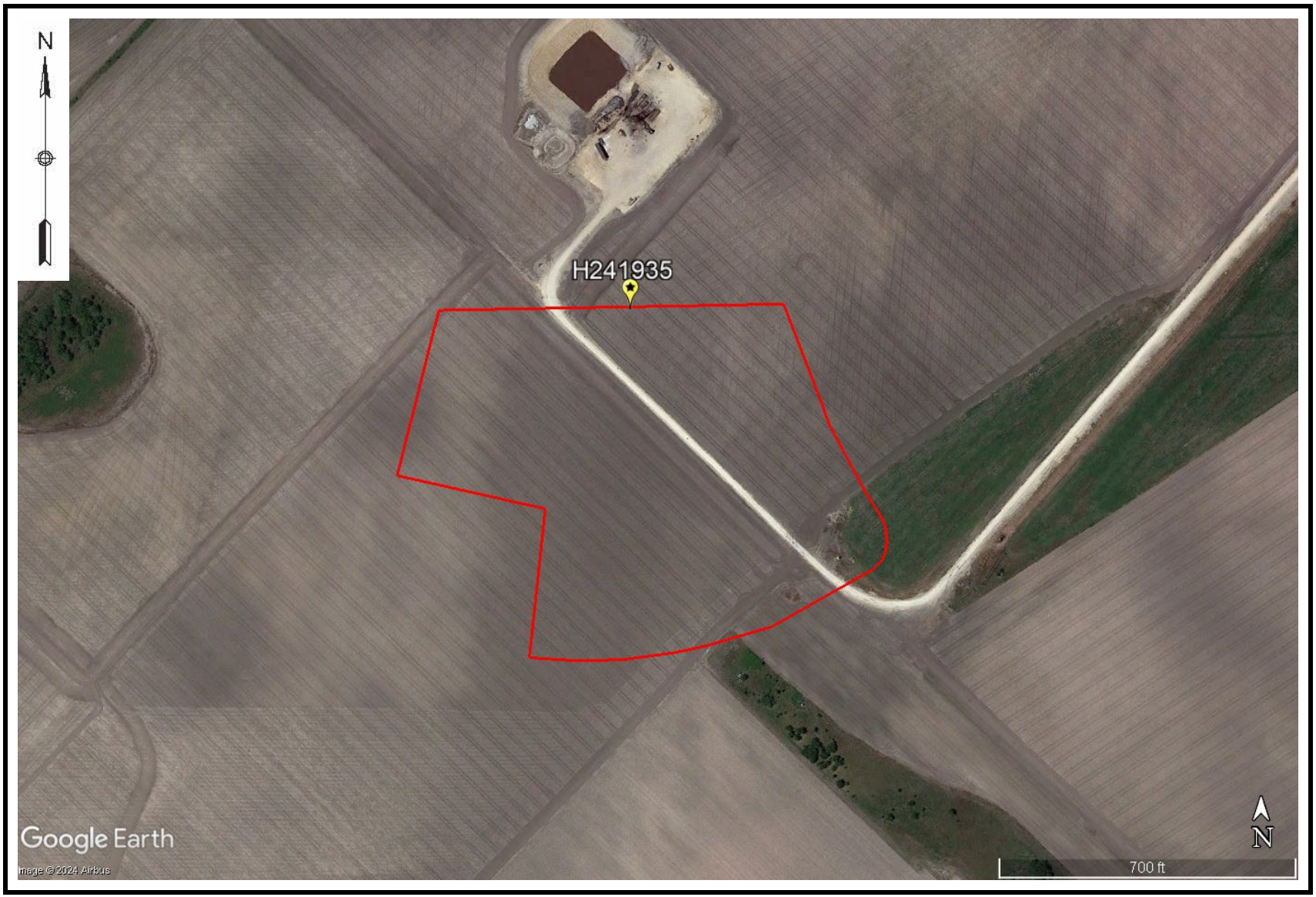
UES Project No. H241935

Elementary #38 for LCISD

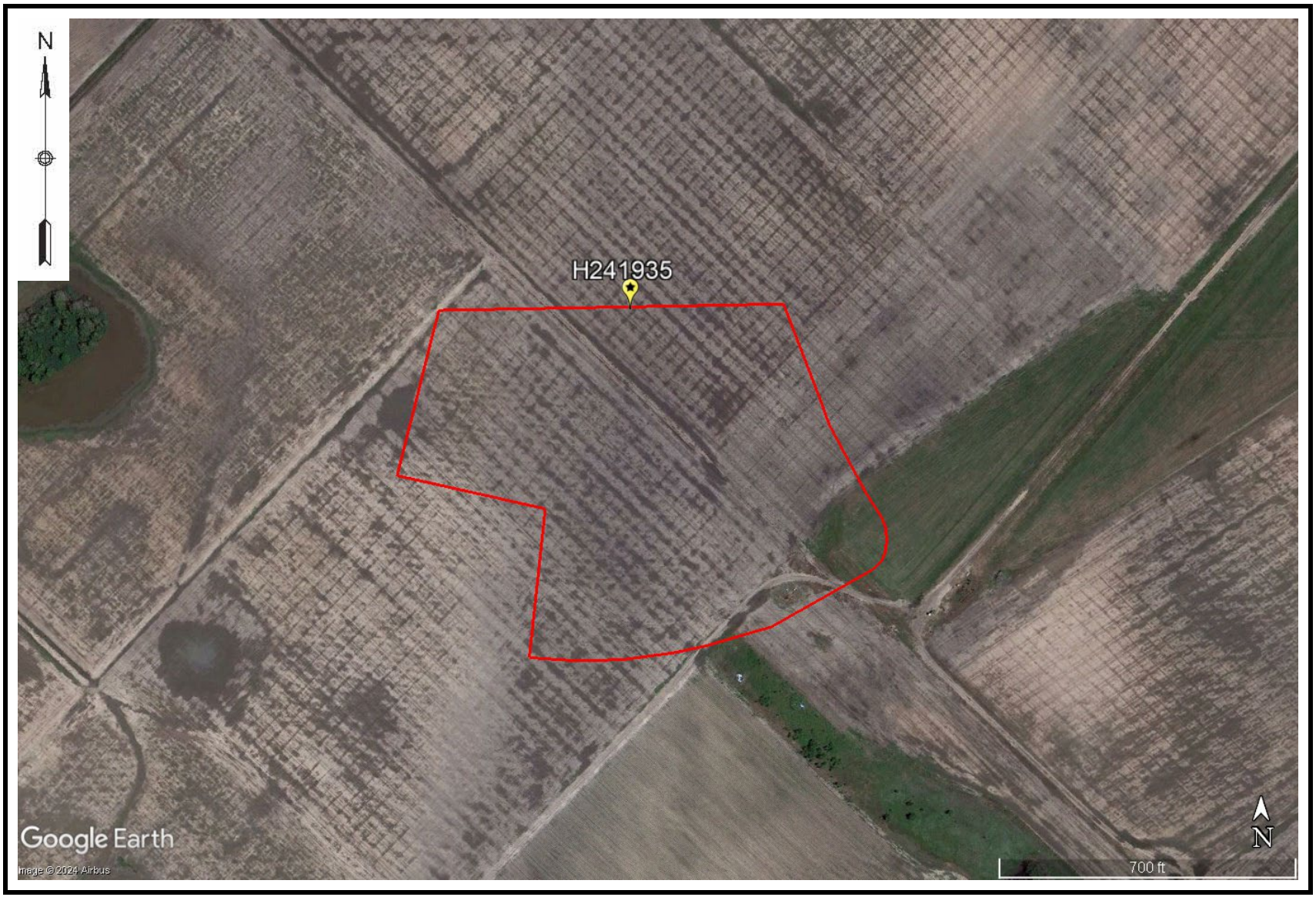
AERIAL PHOTOGRAPH - 2019



AERIAL PHOTOGRAPH - 2014



AERIAL PHOTOGRAPH - 2012

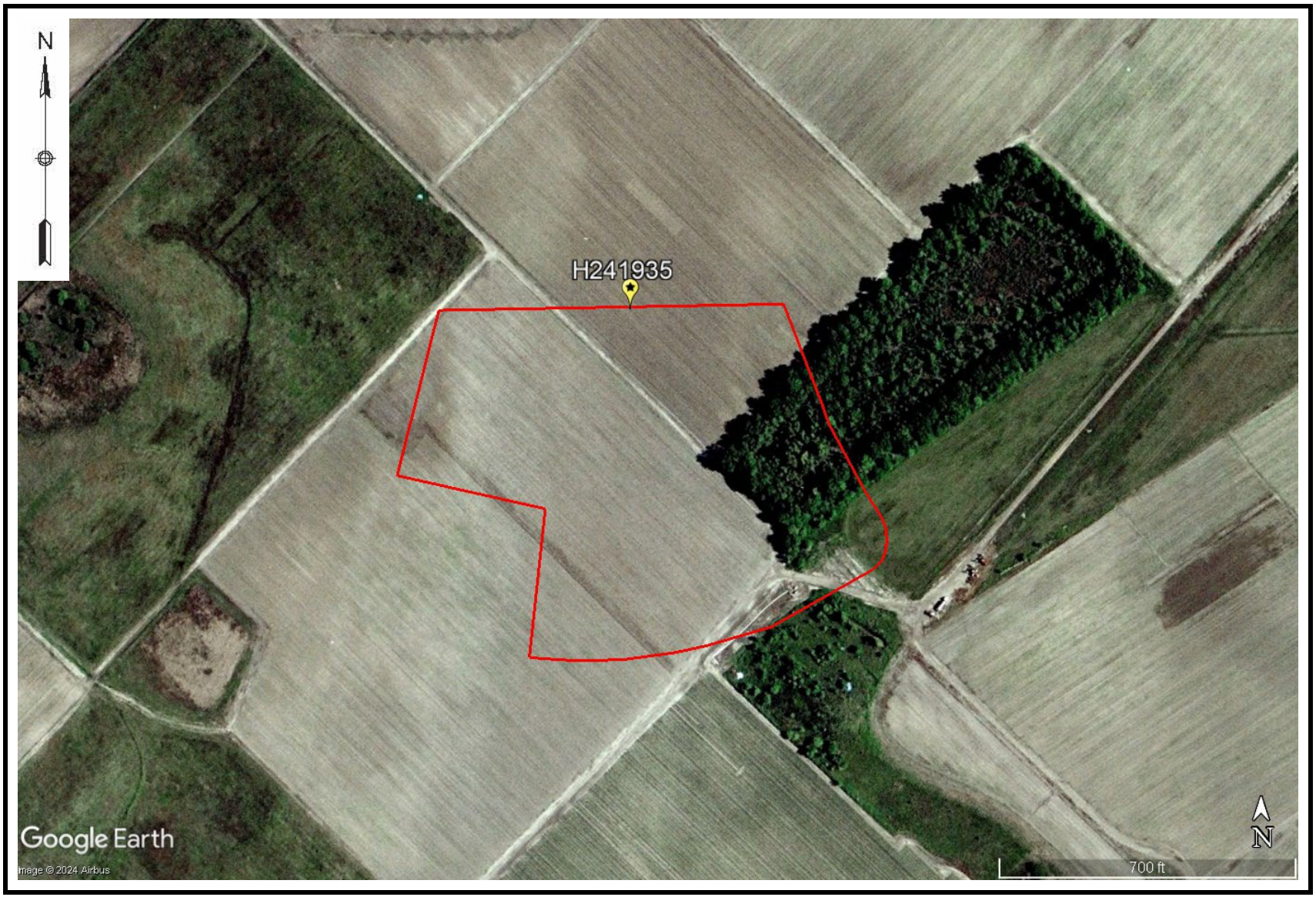


AERIAL PHOTOGRAPH - 2008

UES Project No. H241935

Elementary #38 for LCISD

AERIAL PHOTOGRAPH - 2006

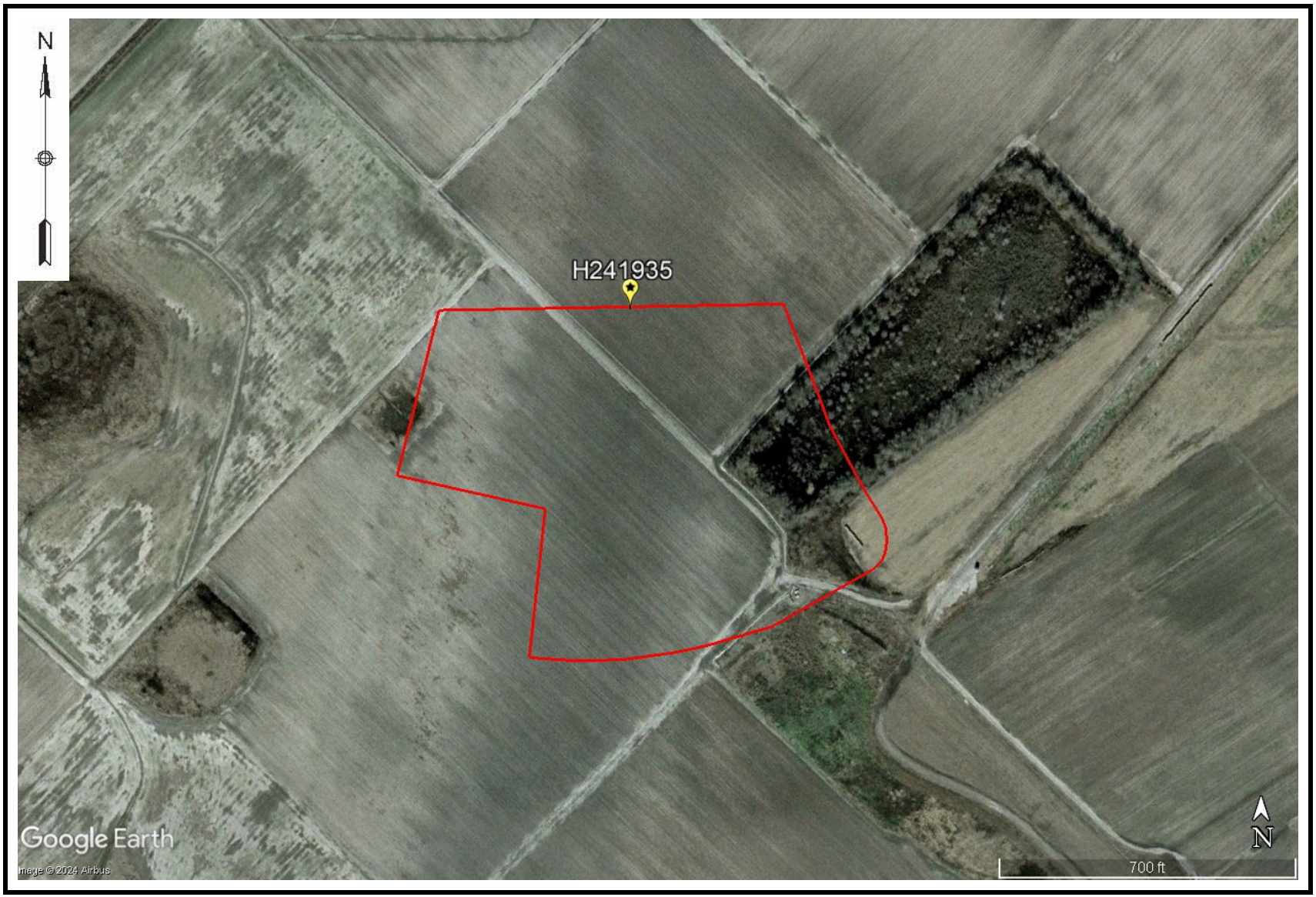


AERIAL PHOTOGRAPH - 2004

UES Project No. H241935

Elementary #38 for LCISD

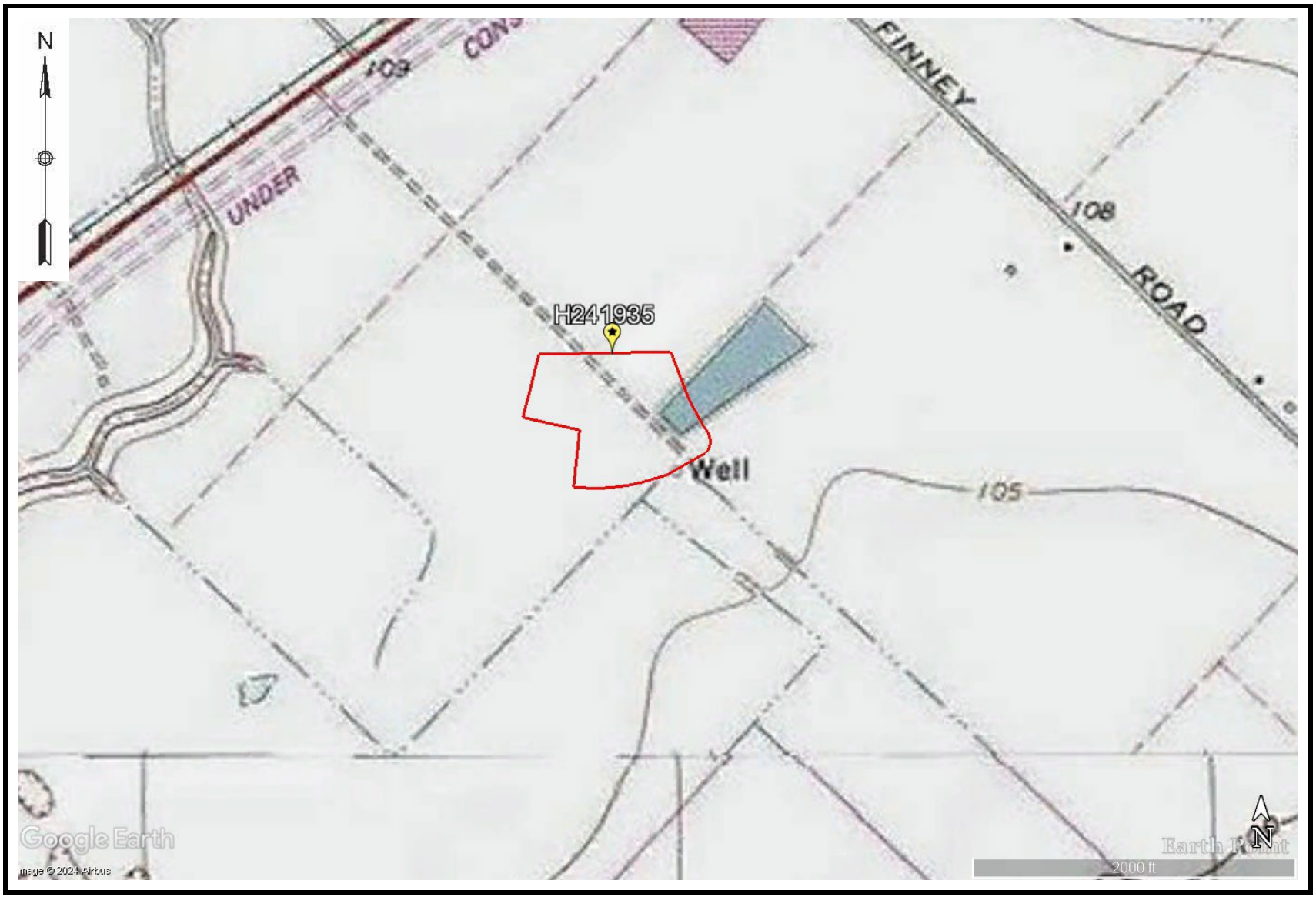
AERIAL PHOTOGRAPH - 2002



AERIAL PHOTOGRAPH - 1995

Appendix E - USGS Topographic Map

USGS TOPOGRAPHIC MAP



Appendix F - Site Photographs

SITE PHOTOGRAPHS

Facing West at Boring B-07

Facing East at Boring B-08

Facing North at Boring B-09

Facing North at Boring B-10

SITE PHOTOGRAPHS

Facing West at Boring B-14

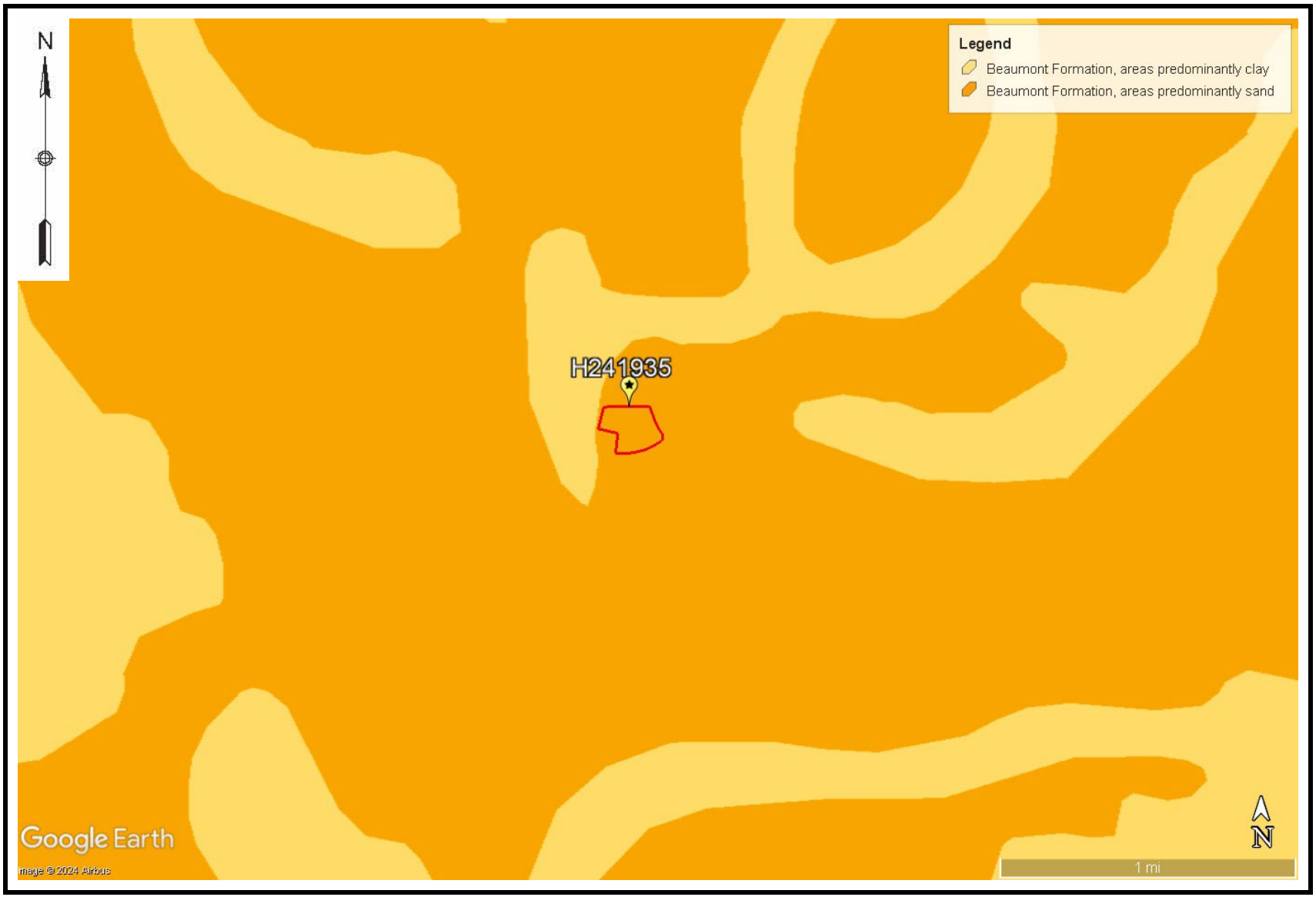
Facing East at Boring B-15

Facing East at Boring B-17

Facing North at Boring B-18

Appendix G - Geologic Information

GEOLOGIC ATLAS



Mineral Resources On-Line Spatial Data

Beaumont Formation, areas predominantly sand

Beaumont Formation, areas predominantly sand

State	Texas
Name	Beaumont Formation, areas predominantly sand
Geologic age	Phanerozoic | Cenozoic | Quaternary | Pleistocene-Late
Original map label	Qbs
Comments	(from Moore and Wermund, 1993a, 1993b) Yellowish- to brownish-gray, locally reddish orange, v. fine to fine quartz sand, silt, and minor fine gravel, intermixed and interbedded. Includes stream channel, point-bar, cravasse-splay, and natural levee ridge deposits, and clayey fill in abandoned channels. Forms poorly defined meander-belt ridges and pimple mounds aligned approx. normal to coast and 1-2 m higher than surround interdistributary silt and clay. Channel fill is dk-brn to brnish-dark-gray, laminated clay and silt, organic -rich. Includes marine delta-front sand, lagoonal clay, and near-shore marine sand beneath and landward of bays along the coast. Interfingers with the interdistributary facies of Beuamont Fm. and rests disconformably on Lissie Fm. Thickness 3-10 m on outcrop; thickens in southeastward in subsurface to more than 100 m.
Primary rock type	sand
Secondary rock type	silt
Other rock types	clay or mud; gravel
Lithologic constituents	Major Unconsolidated > Coarse-detrital > Sand *(Bed)* Minor Unconsolidated > Fine-detrital *(Bed)*
Map references	Bureau of Economic Geology, 1992, Geologic Map of Texas: University of Texas at Austin, Virgil E. Barnes, project supervisor, Hartmann, B.M. and Scranton, D.F., cartography, scale 1:500,000
Unit references	Moore, D.W. and Wermund, E.G., Jr., 1993b, Quaternary geologic map of the Monterrey 4 x 6 degree quadrangle, United States: U.S. Geological Survey Miscellaneous Investigations Series Map I-1420 (NG-

14), scale 1:1,000,000.
[http://pubs.er.usgs.gov/publication/i1420(NG14)]

Moore, D.W. and Wermund, E.G., Jr., 1993a, Quaternary geologic map of the Austin 4 x 6 degree quadrangle, United States: U.S. Geological Survey Miscellaneous Investigations Series Map I-1420 (NH-14), scale 1:1,000,000.
[http://pubs.er.usgs.gov/publication/i1420(NH14)]

Bureau of Economic Geology, 1975, Corpus Christi Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Bureau of Economic Geology, 1975, Beeville-Bay City Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Bureau of Economic Geology, 1982, Houston Sheet, Geologic Atlas of Texas, Bureau of Economic Geology, University of Texas at Austin, scale 1:250,000.

Geographic coverage Aransas - Austin - Bee - Brazoria - Calhoun - Cameron - Chambers - Colorado - Fort Bend - Galveston - Hardin - Harris - Houston - Jackson - Jasper - Jefferson - Jim Wells - Kleberg - Liberty - Live Oak - Matagorda - Montgomery - Newton - Nueces - Orange - Polk - Refugio - San Jacinto - San Patricio - Trinity - Tyler - Victoria - Walker - Wharton - Willacy

Show this information as [XML] - [JSON]

Appendix H - Unified Soil Classification System

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

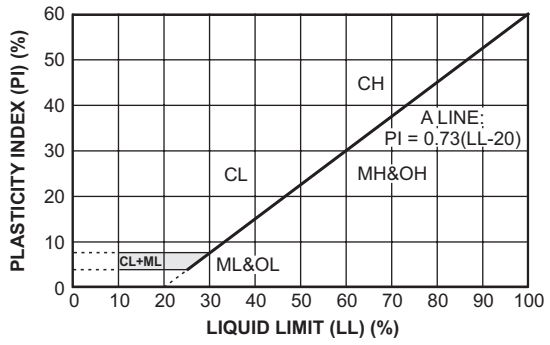
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



TERMS DESCRIBING SOIL CONSISTENCY

Fine Grained Soils		Coarse Grained Soils		
Description	Penetrometer Reading (tsf)	Penetration Resistance (blows/ft)	Description	Relative Density
Soft	0.0 to 1.0	0 to 4	Very Loose	0 to 20%
Firm	1.0 to 1.5	4 to 10	Loose	20 to 40%
Stiff	1.5 to 3.0	10 to 30	Medium Dense	40 to 70%
Very Stiff	3.0 to 4.5	30 to 50	Dense	70 to 90%
Hard	4.5+	Over 50	Very Dense	90 to 100%

SECTION 02 41 17 **DEMOLITION**

PART 1 – GENERAL

1.01 DESCRIPTION

A. This Section specifies the requirements for demolition of facilities and structures.

B. Extent of demolition work is shown on Drawings. Demolition may, but not necessarily, require removal and disposal, off the Work Site, of the following:

1. Building structures, as indicated on Drawings, except items to be removed by WISD prior to start of work.

2. Entrances, drives, parking lots and structures, and adjacent landscape work to limits indicated on Drawings.

3. Building foundations and supporting walls to a uniform depth of 12 inches below lowest foundation elevation.

4. Paving, curbs, gutters, walkways, and related concrete and asphalt.

1.02 SUBMITTALS

A. In accordance with Section 01340 - Shop Drawings, Product Data, Samples, and Record Documents of these Specifications, the following shall be submitted:

1. Proposed methods and operations of building demo to WISD for review and approval prior to start of Work. Include required coordination by agencies for shut-off, capping, and continuation of utility services as required. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of WISD operations.

1.03 QUALITY ASSURANCE/JOB CONDITIONS

A. Reference Standards Applicable to this Section

1. ANSI: American National Standards Institute

   a. A10.6 Safety Requirements for Demolition Operations

2. NFPA: National Fire Protection Association.

   a. 30: Flammable and combustible Liquids Code

   b. 241: Standard for Safeguarding Building Construction and Demolition Operations.

B. Regulations

Comply with applicable OSHA and EPA regulations and codes and local ordinances.

C. Occupancy

Structures to be demolished will be discontinued in use prior to start of Work.

D. Condition of Structures and Work Site

WISD assumes no responsibility for actual condition of structures to be demolished. Conditions existing at time of inspection for bidding purposes will be maintained by WISD insofar as practicable. However, variations within structure and Work Site may occur prior to start of demolition work.

E. Partial Removal

Items of value to Contractor may be removed, as directed, as Work progresses. Salvaged items shall become the property of the Contractor and shall be transported from Site as they are removed. Storage or sale of removed items on-Site will not be permitted.

F. Explosives

Use of explosives will not be permitted.

G. Traffic

Contractor shall comply with Section 01570 - Traffic Regulation of these Specifications. Conduct demolition operations and removal of debris to ensure minimum interference with WISD operations, roads, streets, walks, and adjacent facilities. Do not close or obstruct streets, walks or other facilities without written permission from authorities having jurisdiction. Provide and identify alternate routes around closed or obstructed traffic ways as required by governing regulations.

H. Protection

Contractor shall comply with Section 01510 - Temporary Facilities of these Specifications. Ensure safe passage of persons around area of demolition. Conduct operations to prevent injury to persons and adjacent buildings, structures, and facilities. Erect temporary covered passageways as required by authorities having jurisdiction. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

I. Damages

Promptly repair damages caused by demolition operations at no cost to WISD or adjacent property owners.

J. Utility Services

Contractor shall comply with Section 01541 - Maintenance and Protection of Utilities of these Specifications. Maintain existing utilities indicated to remain, keep in like service, and protect against damage during demolition operations. Do not interrupt existing utilities serving facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary service during interruptions to existing utilities, as acceptable to governing authorities. Contractor shall disconnect and seal utilities serving structures to be demolished, prior to start of demolition work, upon written direction of WISD and utility owner.

PART 2 - PRODUCTS (Not used)

PART 3 - EXECUTION

3.01 DEMOLITION

A. General

Contractor shall comply with NFPA 241 and ANSI A 10.6 prior to and during commencement of demolition.

B. Pollution Control

Contractor shall comply with Section 01560 - Environmental Impact Controls of these Specifications. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air to lowest practical level. comply with governing EPA, OSHA, and local regulations pertaining to environmental protection. Do not create hazardous or objectionable conditions such as flooding and water pollution. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by governing authorities. Return adjacent areas to condition existing prior to start of Work.

C. Building Demolition

Demolish building and structures completely and remove from Work Site. Use such methods as required to complete Work within limitations of governing regulations.

1. Proceed with demolition in systematic manner, from top of structure to ground.

2. Demolish concrete and masonry in small sections.

3. Break up and remove concrete and asphalt slabs-on-grade, unless otherwise shown to remain.

D. Below-Grade Construction

Demolish foundation walls to a depth of not less than 12 inches below subgrade or lowest foundation element. Demolish and remove below-grade wood, metal construction, floor construction, and concrete and asphalt slabs.

E. Filling Voids

1. Completely fill below-grade areas and voids resulting from demolition. Coordinate with work of Sections 311100 – Clearing and Grubbing, and 310000 – Earthwork of these Specifications.

2. Use satisfactory soil materials consisting of stone, gravel, and sand, free from debris, trash, frozen materials, roots and other organic matter.

3. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.

4. Place fill materials in horizontal layers not exceeding 8 inches in loose depth. compact each layer at optimum moisture content of fill material to a density as specified in Section 310000 - Earthwork of these Specifications.

5. After fill placement and compaction as specified, grade surface to meet adjacent contours and to provide flow to surface drainage structures.

3.02 DISPOSAL OF DEMOLISHED MATERIALS

A. General

Remove from Work Site debris, rubbish, and other materials resulting from demolition operations. Burning of removed materials from demolished structures will not be permitted on Site.

B. Removal

Safely transport demolished materials and dispose of legally off Site. Contractor shall comply with NFPA 241, ANSI A 10.6, and NFPA 30, as applicable to the Work of disposal and transport.

END OF SECTION 02 41 17

SECTION 03 05 16 UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 03 30 00 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.3 REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Test Data: Submit report of tests showing compliance with specified requirements.

D. Samples: Submit samples of underslab vapor barrier to be used.

E. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Underslab Vapor Barrier:

1. Water Vapor Permeance: Not more than 0.010 perms, maximum.

2. Complying with ASTM E1745 Class A.

3. Thickness: 15 mils.

4. Product:

a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com .

b. W.R. Meadows; Perminator. www.wrmeadows.com.

c. Reefindustries; Griffolyn. www.reefindustries.com.

d. Substitutions: Not permitted.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.2 INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION 03 05 16

SECTION 03 10 00 CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.

B. Openings for other work.

C. Form accessories.

D. Form stripping.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.

B. Section 03 30 00 - Cast-in-Place Concrete.

C. Section 05 12 00 - Structural Steel: Placement of embedded steel anchors and plates in cast-in-place concrete.

D. Section 05 21 00 - Steel Joist Framing: Placement of embedded steel anchors, plates and joist seats in cast-in-place concrete.

E. Section 05 31 00 - Steel Decking: Placement of steel anchors in composite decking.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).

C. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).

D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

E. ASME A17.1 - Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices; 2022.

F. PS 1 - Structural Plywood; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on void form materials and installation requirements.

C. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.

D. Design Data: As required by authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design formwork under direct supervision of a Professional Structural Engineer experienced in design of concrete formwork and licensed in the State in which the Project is located.

B. Maintain one copy of each installation standard on site throughout the duration of concrete work.

PART 2 PRODUCTS

2.1 FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.

C. Chamfer outside corners of beams, joists, columns, and walls.

D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

E. Comply with relevant portions of ACI CODE-318, ACI PRC-347, and ACI SPEC-301.

F. Use the following form types:

1. Basement Walls Not Exposed To View: Site fabricated plywood.

2. Basement Walls Exposed To View: Site fabricated rough sawn lumber.

3. Elevated Floor Slabs: Prefabricated glass fiber pan forms, treated for exposed to view finish.

4. Elevated Floor/Roof Slabs: Permanent prefabricated foam panel formwork; formwork to remain.

2.2 WOOD FORM MATERIALS

A. Softwood Plywood: PS 1, B-B High Density Concrete Form Overlay, Class I.

2.3 FORMWORK ACCESSORIES

A. Form Ties: Removable type, galvanized metal, adjustable length, cone type, with waterproofing washer, 2 inch back break dimension, free of defects that could leave holes larger than 1 inch in concrete surface.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Do not use materials containing diesel oil or petroleum-based compounds.

2. Products:

a. Kaufman Products Inc; FormKote Emulsion: www.kaufmanproducts.net/#sle.

b. Nox-Crete Inc; Pro Release: www.nox-crete.com.

c. SpecChem, LLC; Bio Strip WB (water-based): www.specchemllc.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

3. Composition: Colorless, reactive, solvent-based compound.

a. VOC Content: In compliance with applicable local, State, and federal regulations.

b. Products:

1) Nox-Crete Inc; Quick Release Series: www.nox-crete.com/#sle.

2) SpecChem, LLC; SpecStrip: www.specchemllc.com/#sle.

C. Dowel Sleeves: Plastic sleeve and nailable plastic base for smooth, round, steel load-transfer dowels.

1. Products:

a. BoMetals, Inc: www.bometals.com.

D. Dovetail Anchor Slot: Galvanized steel, at least 22 gage, 0.0299 inch thick, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

E. Flashing Reglets: Galvanized steel, at least 22 gage, 0.0299 inch thick, longest possible lengths, with alignment splines for joints, foam filled, release tape sealed slots, anchors for securing to concrete formwork.

F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

G. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 12 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Install stay in place mesh steel formwork in accordance with manufacturer's recommendations.

D. Install permanent insulated foam panel formwork per manufacturer's recommendations.

E. Arrange and assemble formwork to permit dismantling and stripping. Do not damage concrete during stripping. Permit removal of remaining principal shores.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Obtain approval before framing openings in structural members that are not indicated on drawings.

H. Coordinate this section with other sections of work that require attachment of components to formwork.

I. If formwork is placed after reinforcement, resulting in insufficient concrete cover over reinforcement, request instructions from Architect before proceeding.

3.4 APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

C. Do not apply form release agent where concrete surfaces will receive special finishes, stained concrete, applied coverings, stained concrete, or stained concrete that are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces coated prior to placement of concrete.

3.5 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for items to be embedded in passing through concrete work.

B. Locate and set in place items that will be cast directly into concrete.

C. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

D. Position recessed anchor slots for brick veneer masonry anchors to spacing and intervals specified in Section 04 26 13.

E. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

F. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.

G. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6 FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean and protect permanent insulated concrete foam panel formwork per manufacturer's recommendations.

C. Clean formed cavities of debris prior to placing concrete.

1. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

2. During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

3.7 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.

B. Construct permanent insulated foam panel formwork to maintain tolerances required by ACI SPEC-301.

C. Construct and align formwork for elevator hoistway in accordance with ASME A17.1.

D. Camber slabs and beams 1/4 inch per 10 feet.

3.8 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

C. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.

3.9 FORM REMOVAL

A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION 03 10 00

SECTION 03 21 00 SITE CONCRETE REINFORCEMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. This WORK shall consist of furnishing and placing reinforcing steel in accordance with these SPECIFICATIONS and in conformity with the DRAWINGS.

1.2 RELATED SECTIONS

A. The following is a list of SPECIFICATIONS which may be related to this section:

1. Section 32 13 73.19 Cast in Place Concrete

1.3 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State and Highway Transportation Officials (AASHTO):

a. M31M/M31, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

b. AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges.

2. American Concrete Institute (ACI):

a. ACI Detailing Manual.

b. 117, Specifications for Tolerance for Concrete Construction and Materials.

c. 318, Building Code Requirements for Structural Concrete.

3. American Welding Society (AWS):

a. D1.1/D1.1M, Structural Welding Code - Steel.

b. D1.4/D1.4M, Structural Welding Code - Reinforcing Steel.

c. D2.0, Welded Highway and Railway Bridges.

4. ASTM International (ASTM):

a. A82/A82M, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

b. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.

c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

d. A996/A996M, Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.

e. A706/A706M, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

f. A767/A767M, Standard Specification for Zinc-coated (Galvanized) Steel Bars for Concrete Reinforcement.

g. A775/A775M, Standard Specification for Epoxy-coated Steel Reinforcing.

5. Concrete Reinforcing Steel Institute (CRSI):

a. Manual of Standard Practice.

b. Placing Reinforcing Bars.

1.4 SUBMITTALS

A. Two copies of a list of all reinforcing steel and bending diagrams shall be furnished to the ENGINEER at the site of the work at least one week before the placing of reinforcing steel is begun. Such lists will not be reviewed for accuracy. The CONTRACTOR shall be responsible for the accuracy of the lists and for furnishing and placing all reinforcing steel in accordance with the details shown on the plans.

1.5 DELIVERY, STORAGE, AND PROTECTION

A. Reinforcing steel shall be stored off the ground and protected from oil or other materials detrimental to the steel or bonding capability of the reinforcing bar. Epoxy coated reinforcing bars shall be stored on protective cribbing.

PART 2 - PRODUCTS

2.1 REINFORCING STEEL

A. Deformed Bars: All bar steel reinforcement shall be of the deformed type, ASTM A615, AASHTO M31M/M31, and Grade (40 or 60) as specified on the DRAWINGS. B. Spirals:

1. Spirals, hot-rolled plain or deformed bars per ASTM A615, Grade 60 or cold drawn wire per ASTM A82/A82M as specified on the DRAWINGS.

2. Spirals for columns shall have two (2) “spacers” with a section modulus >0.030in^3 in order to maintain the proper pitch and spacing.

B. Epoxy-Coated Reinforcing Bars: Epoxy-coated reinforcing bars shall conform to ASTM A775/A775M. When required, damaged epoxy coating shall be repaired with patching material conforming to ASTM A775/A775M in accordance with the material manufacturer’s recommendations.

C. Zinc-coated (Galvanized Reinforcing Bars): Zinc-coated reinforcing bars shall conform to ASTM A767/A767M. When required, damaged zinc coating shall be repaired with a zinc-rich formulation conforming to ASTM A767/A767M.

D. Welded Wire Fabric: All welded wire fabric reinforcement shall conform to ASTM A497/A497M. F. Identification:

1. Bundles of reinforcing bars and wire spirals shall be tagged, with a metal tag, showing specification, grade, size, quantity, and suitable identification to permit checking, sorting, and placing. When bar marks are used to identify reinforcing bars on the DRAWINGS, the bar mark shall be shown on the tag. Tags shall be removed prior to concrete placement.

2. Bundles of flat sheets and rolls of welded wire fabric shall be tagged similar to reinforcing bars.

2.2 TIE WIRE

A. 16 gauge wire ties, manufactured by American Wire Tie, Inc., or equal. When epoxy coated reinforcing steel is shown on the DRAWINGS, PVC coated wire ties shall be used. The minimum PVC coating shall be 0.7 mils.

2.3 BAR SUPPORTS

A. General: Bar supports and spacing shall be in accordance with the CRSI Manual of Standard Practice, Chapter 3, a maximum of four (4) feet, or as required by the DRAWINGS.

B. Floor Slabs: Uncoated steel or non-metallic composite chairs shall be used unless otherwise shown on the DRAWINGS. If required by ENGINEER, the chair shall be stapled on a bearing pad to prevent chair displacement. The bearing pad shall be made of exterior grade plywood and be approximately five (5) inches square.

C. Columns: Plastic “space wheels” manufactured by Aztec (Model DO 12/40), or equal, are required.

D. Epoxy-Coated and Zinc-Coated Bar Supports: Epoxy-coated reinforcing bars supported from formwork shall rest on coated wire bar supports made of dielectric or other acceptable materials. Wire supports shall be fully coated with dielectric material, compatible with concrete. Reinforcing bars used as support bars shall be epoxy-coated. In walls reinforced with epoxy-coated bars, spreader bars shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing shall be made of corrosion-resistant material or coated with dielectric material.

2.4 FABRICATION

A. Fabrication tolerances for straight and bent bars shall be in accordance with the requirements of Subsection 4.3, Tolerance, of ACI 315 and the CRSI Manual of Standard Practice.

PART 3 – EXECUTION

3.1 GENERAL

A. Rust, seams, surface irregularities, or mill scale shall not be cause for rejection provided that the weight and height of deformations of a hand-wire-brushed test specimen are not less than the applicable ASTM Specification.

3.2 BAR LIST

A. CONTRACTOR shall be responsible for the accuracy of the lists and for furnishing and placing all reinforcing steel in accordance with the details shown on the DRAWINGS.

B. Bar lists and bending diagrams for structures, which are included on the DRAWINGS, do not have to be furnished by CONTRACTOR. When bar lists and bending diagrams are included on the DRAWINGS, they are intended for estimating approximate quantities. CONTRACTOR shall verify the quantity, size, and shape of the bar reinforcement against those shown on the DRAWINGS and make any necessary corrections before ordering.

3.3 BENDING

A. All reinforcing bars shall be bent cold. Bars partially embedded in concrete shall not be field bent, except as shown on the DRAWINGS or permitted. Bars shall not be bent or straightened in a manner that may injure the material.

3.4 SPIRALS

A. One and one-half (1-1/2) finishing bends are required at the top and bottom of the spiral. Spacers shall be provided in accordance with Chapter 5, Section 9 of the CRSI Manual of Standard Practice. Welding as an aid to fabrication and/or installation is not permitted.

3.5 PLACING AND FASTENING

A. When placed in the WORK, the reinforcing bars shall be free from dirt, loose mill scale, paint, oil, loose rust, or other foreign substance.

B. The placing, fastening, splicing, and supporting of reinforcing steel and wire mesh or bar mat reinforcement shall be in accordance with the DRAWINGS and the latest edition of “CRSI Placing Reinforcing Bars.” In case of discrepancy between the DRAWINGS and the CRSI publication stated above, the DRAWINGS shall govern. Reinforcement shall be placed within the tolerances provided in ACI 117.

C. Steel reinforcement shall be accurately placed in the positions shown on the DRAWINGS and firmly held during the placing and setting of concrete by means of spacer strips, stays, metal chairs or other approved devices or supports. Precast concrete bricks or other types of bricks are not permitted for support of reinforcement in footings, slabs, or any other part of the work. Chair and bolster supports for slabs and walls shall be spaced at a maximum of four- (4-) foot centers unless otherwise shown on the DRAWINGS. Staples used to attach bar supports to wall and roof forms shall have the staple “tails” clipped after form removal. For columns, three (3) wheels, spaced one hundred twenty degrees (120°) apart, shall be placed every four (4) feet of column height. CONTRACTOR may increase the column spiral pitch if a conflict occurs with the wheel. Pre-tied column reinforcing steel lowered into column forms shall be lowered vertically to prevent damage to the space wheels.

D. Bars shall be securely tied at fifty percent (50%) of all intersections except where spacing is less than one (1) foot in each direction, when alternate intersections shall be tied unless otherwise called out on the DRAWINGS or in applicable SPECIFICATIONS. Tying of steel by spot welding shall not be permitted unless specifically authorized by ENGINEER. The placing and securing of the reinforcement in any unit or section shall be accepted by ENGINEER before any concrete is placed in any such unit or section.

E. Bundle bars shall be tied together at not more than six- (6-) foot centers.

3.6 SPLICING

A. Bar steel reinforcement shall be furnished in the full lengths indicated on the DRAWINGS. Splicing of bars, except where shown on the DRAWINGS, shall not be permitted without the written acceptance of ENGINEER. Splices shall be staggered. In cases where permission is granted to splice bars, other than those shown on the DRAWINGS, the additional material required for the lap shall be furnished by CONTRACTOR at CONTRACTOR's own expense. The minimum distance between staggered splices for reinforcing bars shall be the length required for a lapped splice in the bar. All splices shall be full contact splices.

B. Splices shall not be permitted at points where the section is not sufficient to provide a minimum distance of two (2) inches between the splice and the nearest adjacent bar or the surface of the concrete.

C. Welding of reinforcement shall be done only if detailed on the DRAWINGS or if authorized by ENGINEER in writing. Welding shall be done by a certified welder. The welding shall conform to AWS D1.4/D1.4M with the modifications and additions specified hereinafter. Where AWS D2.0 Specifications for Welded Highway and Railway Bridges is referenced, the reference shall be construed to be for AWS D1.1. Where the term AWS D1.1/D1.1M is used it shall mean the American Welding Society Structural Welding Code, D1.5/D1.5M as modified and amended by the AASHTO Standard Specifications for Welding of Structural Steel Highway Bridges. After completion of welding, coating damage to coated reinforcing steel bars shall be repaired.

D. When required or permitted, a mechanical connection may be used to splice reinforcing steel bars or as substitution for dowel bars. The mechanical connection shall be capable of developing a minimum of one hundred twenty five percent (125%) of the yield strength of the reinforcing bar in both tension and compression. All parts of mechanical connections used on coated bars, including steel splice sleeves, bolts, and nuts shall be coated with the same material used for repair of coating damage.

3.7 CUTTING

A. When coated reinforcing bars are cut in the field, the ends of the bars shall be coated with the same material used for repair of coating damage.

END OF SECTION 03 21 00

SECTION 03 30 00 CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete for composite floor construction.

B. Floors and slabs on grade.

C. Concrete foundation walls.

D. Joint devices associated with concrete work.

E. Miscellaneous concrete elements, including equipment pads.

F. Concrete curing.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

D. Section 32 13 13 - Concrete Paving: Sidewalks, curbs and gutters.

1.3 REFERENCE STANDARDS

A. ACI 211.2 - Standard Practice for Selecting Proportions for Structural Lightweight Concrete; 1998 (Reapproved 2004).

B. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

C. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.

D. ACI PRC-302.1 - Guide to Concrete Floor and Slab Construction; 2015.

E. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

F. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.

G. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.

H. ACI PRC-308 - Guide to External Curing of Concrete; 2016.

I. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

J. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2023.

L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2023.

M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2024.

N. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.

O. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2022.

Q. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2023.

R. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

S. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019, with Editorial Revision (2022).

T. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2023, with Editorial Revision.

U. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

V. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.

W. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2020a.

X. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2020.

Y. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.

Z. ASTM D471 - Standard Test Method for Rubber Property--Effect of Liquids; 2016a (Reapproved 2021).

AA. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.

BB. ASTM E1155 - Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers; 2020.

CC. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

DD. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2017 (Reapproved 2023).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

2. For chemical-resistant waterstops, provide data on ASTM D471 test results.

C. Mix Design: Submit proposed concrete mix design.

1. Indicate proposed mix design complies with requirements of ACI SPEC-301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI CODE-318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Samples: Submit two, 12 inch long samples of construction joint devices.

F. Test Reports: Submit report for each test or series of tests specified.

G. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

1.5 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.

1. Maintain one copy of each document on site.

B. Follow recommendations of ACI PRC-305 when concreting during hot weather.

C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 FORMWORK

A. Comply with requirements of Section 03 10 00.

2.2 REINFORCEMENT MATERIALS

A. Comply with requirements of Section 03 20 00.

2.3 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type II - Moderate Portland type.

1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C33/C33M.

1. Acquire aggregates for entire project from same source.

C. Fly Ash: ASTM C618, Class C or F.

D. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.4 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

1. Products:

a. Euclid Chemical Company; PLASTOL 6420: www.euclidchemical.com.

b. Master Builders Solutions, MasterGlenium Series: www.master-builders-solutions.com

c. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 ACCESSORY MATERIALS

A. Underslab Vapor Retarder:

1. Sheet Material: ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. Single-ply polyethylene is prohibited.

2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.

3. Products:

   a. Inteplast Group; Barrier-Bac VB-350: www.barrierbac.com.

   b. ISI Building Products; Viper VaporCheck II 15-mil (Class A): www.isibp.com.

   c. Stego Industries, LLC: www.stegoindustries.com.

   d. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils (0.38 mm): www.wrmeadows.com.

   e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Shrink Cementitious Grout: Premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing agents.

1. Grout: Comply with ASTM C1107/C1107M.

2. Height Change, Plastic State; when tested in accordance with ASTM C827/C827M:

   a. Maximum: Plus 4 percent.

   b. Minimum: Plus 1 percent.

3. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

4. Flowable Products:

   a. Kaufman Products Inc; SureGrout: www.kaufmanproducts.net.

   b. L&M Construction Chemicals, Inc, a subsidiary of Laticrete International, Inc; DURAGROUT: www.laticrete.com/our-products/concrete-construction-chemicals.

   c. SpecChem, LLC; SC Precision Grout: www.specchemllc.com.

   d. US Spec, an Oldcastle brand; MP Grout: www.usspec.com/#sle.

   e. W. R. Meadows, Inc; 588-10K: www.wrmeadows.com.

   f. Substitutions: See Section 01 60 00 - Product Requirements.

5. Low-Slump, Dry Pack Products:

   a. Dayton Superior Corporation: www.daytonsuperior.com.

   b. Five Star Products, Inc; Five Star Grout: www.fivestarproducts.com.

   c. SpecChem, LLC; SC Multipurpose Grout: www.specchemllc.com.

d. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:

1. Complying with ASTM C881/C881M and of Type required for specific application.

2. Products:

a. CTS Cement Manufacturing Corporation; Fast Anchoring and Repair Adhesive: www.CTScement.com/#sle.

b. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com.

c. Dayton Superior Corporation: www.daytonsuperior.com.

d. Kaufman Products Inc; SurePoxy HM EPL: www.kaufmanproducts.net.

e. Mapei Corporation; Planibond 3C: www.mapei.com/#sle.

f. Pecora; Dynapoxy Low-Mod Epoxy: www.pecora.com.

g. SpecChem, LLC; SpecPoxy 1000, SpecPoxy 2000, SpecPoxy 3000, or SpecPoxy 3000FS: www.specchemllc.com.

h. W. R. Meadows, Inc; Rezi-Weld Gel Paste, Rezi-Weld Gel Paste State, Rezi-Weld 1000: www.wrmeadows.com.

i. Substitutions: See Section 01 60 00 - Product Requirements.

B. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.

1. Size: As indicated on drawings.

2. Size: 1/2 inch throat, 1/2 inch deep.

C. Slab Isolation Joint Filler: 1/2-inch thick, height equal to slab thickness, with removable top section forming 1/2-inch deep sealant pocket after removal.

1. Material: ASTM D1751, cellulose fiber.

2. Products:

a. Nomaco, Inc; Nomaflex Expansion Joint Filler with Void Cap Option: www.nomaco.com.

b. W. R. Meadows, Inc; Fiber Expansion Joint Filler with Snap-Cap: www.wrmeadows.com.

c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.

1. Products:

a. W. R. Meadows, Inc; Speed-E-Joint: www.wrmeadows.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches on center; ribbed steel stakes for setting.

1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.

2. Height: To suit slab thickness.

3. Manufacturers:

a. BoMetals, Inc: www.bometals.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

1. Manufacturers:

a. BoMetals, Inc; QuicDowel: www.bometals.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

2.7 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.

1. Product dissipates within 4 to 6 weeks.

2. Provide product containing fugitive red dye.

3. Products:

a. Dayton Superior Corporation: www.daytonsuperior.com.

b. Euclid Chemical Company; COLOR-CRETE CURE AND SEAL VOC: www.euclidchemical.com.

c. Kaufman Products Inc; Thinfilm 420 Resin Base: www.kaufmanproducts.net.

d. Mapei Corporation; Mapecure DR: www.mapei.com/#sle.

e. W. R. Meadows, Inc; 1100-Clear: www.wrmeadows.com.

f. Substitutions: See Section 01 60 00 - Product Requirements.

4. Solids Content: 25 percent, minimum.

5. Products:

a. Floor Seal Technology, Inc; VaporSeal 309 System: www.floorseal.com.

b. Forta Corporation: www.forta-ferro.com/#sle.

c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Water: Potable, not detrimental to concrete.

2.8 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.

1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Proportioning Structural Lightweight Concrete: Comply with ACI 211.2 recommendations.

1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

C. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

D. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.

E. Normal Weight Concrete:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.

2. Fly Ash Content: Maximum 25 percent of cementitious materials by weight.

3. Water-Cement Ratio: Maximum 50 percent by weight.

4. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.

5. Maximum Slump: 3 inches.

6. Maximum Aggregate Size: 5/8 inch.

2.9 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

1. Colored Concrete: Add pigments in strict accordance with manufacturer's instructions to achieve consistent color from batch to batch.

B. Transit Mixers: Comply with ASTM C94/C94M.

C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2 PREPARATION

A. Verify that forms are clean and free of rust before applying release agent.

B. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

D. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

E. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

3.3 PLACING CONCRETE

A. Place concrete in accordance with ACI PRC-304.

B. Place concrete for floor slabs in accordance with ACI PRC-302.1.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

G. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.4 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

F. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.5 SEPARATE FLOOR TOPPINGS

A. Prior to placing floor topping, roughen substrate concrete surface and remove deleterious material. Broom and vacuum clean.

B. Place required dividers, edge strips, reinforcing, and other items to be cast in.

C. Apply bonding agent to substrate in accordance with manufacturer's instructions.

D. Apply sand and cement slurry coat on base course, immediately prior to placing toppings.

E. Place concrete floor toppings to required lines and levels.

1. Place topping in checkerboard panels not to exceed 20 feet in either direction.

F. Screed toppings level, maintaining surface flatness of maximum 1:1000.

3.6 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for compliance with specified tolerances.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:

1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.

2. Under Raised Access Flooring: F(F) of 20; F(L) of 15, on-grade only.

3. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.

4. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.

5. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

6. Parking Structure: F(F) of 20; F(L) of 15, on-grade only.

C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155, within 48 hours after slab installation; report both composite overall values and local values for each measured section.

D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.7 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

2. Grout Cleaned Finish: Wet areas to be cleaned and apply grout mixture by brush or spray; scrub immediately to remove excess grout. After drying, rub vigorously with clean burlap, and keep moist for 36 hours.

3. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

D. Concrete Slabs: Finish to requirements of ACI PRC-302.1 and as follows:

1. Surfaces to Receive Thick Floor Coverings: "Wood float" as described in ACI PRC-302.1; thick floor coverings include quarry tile, ceramic tile, and Portland cement terrazzo with full bed setting system.

2. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI PRC-302.1; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.

3. Decorative Exposed Surfaces: Trowel as described in ACI PRC-302.1; take measures necessary to avoid black-burnish marks; decorative exposed surfaces include surfaces to be stained or dyed, pigmented concrete, surfaces to receive liquid hardeners, surfaces to receive dry-shake hardeners, surfaces to be polished, and all other exposed slab surfaces.

E. In areas with floor drains, maintain floor elevation at walls; pitch surfaces uniformly to drains at 1:100 nominal.

F. Concrete Polishing: See Section 03 35 11.

3.8 CURING AND PROTECTION

A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than seven days.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.

a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.

b. Spraying: Spray water over floor slab areas and maintain wet.

c. Saturated Burlap: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides; maintain in place.

3. Final Curing: Begin after initial curing but before surface is dry.

   a. Moisture-Retaining Sheet: Lap strips not less than 3 inches and seal with waterproof tape or adhesive; secure at edges.

   b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.9 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

G. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.10 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

3.12 SCHEDULE - CONCRETE TYPES AND FINISHES - SEE DRAWINGS.

END OF SECTION 03 30 00

SECTION 03 41 13 PRECAST CONCRETE HOLLOW CORE PLANKS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast floor planks.

B. Connection plates with brackets.

C. Grouting plank joint keys.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCE STANDARDS

A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).

B. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A416/A416M - Standard Specification for Low-Relaxation, Seven-Wire Steel Strand for Prestressed Concrete; 2018.

E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

G. IAS AC157 - Accreditation Criteria for Fabricator Inspection Programs for Reinforced and Precast/Prestressed Concrete; 2024.

H. PCI MNL-116 - Manual for Quality Control for Plants and Production of Structural Precast Concrete Products; 2021.

I. PCI MNL-120 - PCI Design Handbook; 2017, with Errata (2021).

J. PCI MNL-123 - Connections Manual: Design and Typical Details of Connections for Precast and Prestressed Concrete; 1988.

K. PCI MNL-124 - Design for Fire Resistance of Precast Prestressed Concrete; 2011.

L. PCI MNL-126 - PCI Manual for the Design of Hollow Core Slabs and Walls; 2015.

M. PCI MNL-135 - Tolerance Manual for Precast and Prestressed Concrete Construction; 2000.

N. PCI (CERT) - PCI Plant Certification; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate location of hanger tabs and devices for mechanical and electrical work and cutting of field openings.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1. Discuss anchor and weld plate locations, sleeve locations, and cautions regarding cutting or core drilling.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate standard component configuration, design loads, deflections, and cambers.

C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

D. Fabricator's Qualification Statement: Provide documentation showing precast concrete fabricator is accredited under IAS AC157.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Design precast concrete hollow core planks under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

C. Fabricator Qualifications: Precast concrete fabricator accredited by IAS according to IAS AC157.

D. Erector Qualifications: Company specializing in performing the type of work specified in this section, with minimum 5 years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Lifting or Handling Devices: Capable of supporting member in positions anticipated during manufacture, storage, transportation, and erection.

B. Mark each member with date of production and final position in structure.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Precast Concrete Hollow Core Planks:

1. Any manufacturer with PCI Plant Certification.

2. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 PRECAST UNITS

A. Precast Hollow Core Planks: Comply with PCI MNL-120, PCI MNL-126, PCI MNL-124 ACI CODE-318, and ACI SPEC-301.

1. Dimensions as indicated on drawings.

2. Design components to withstand dead loads and design loads in the configuration indicated on drawings and as follows:

a. Floor Assembly: 100 pounds per square foot live load, U.N.O. on structural drawings.

b. Maximum Allowable Deflection of Floor Planks: 1/360 of span , cambered to achieve flat surface under dead load, U.N.O. on structural drawings.

3. Design connections in accordance with PCI MNL-123.

4. Design components to accommodate construction tolerances, deflection of other building structural members and clearances of intended openings.

2.3 MATERIALS

A. Concrete Materials: ACI SPEC-301.

B. Tensioning Steel Tendons: ASTM A416/A416M, Grade 250 - 250K psi; seven-wire stranded steel cable; low-relaxation type; full length without splices; weldless; uncoated.

C. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) deformed steel bars.

D. Non-Shrink Grout: Non-metallic, minimum compressive strength of 10,000 psi at 28 days.

E. Cement Grout: Minimum compressive strength of 3,000 psi at 28 days.

2.4 ACCESSORIES

A. Connecting and Supporting Devices: Plates, angles, items cast into concrete, items connected to steel framing members, and inserts: ASTM A36/A36M carbon steel; prime painted.

B. Core Hole End Plugs: Cardboard insert with stiff concrete fill.

C. Hanger Tabs: Galvanized steel, designed to fit into grouted key joints, capable of supporting 500 lbs dead load, predrilled to receive hanger.

D. Bearing Pads: High density plastic, 1/8 inch thick, smooth on one side. Vulcanized elastomeric compound molded to size.

E. Sill Seal: Compressible glass fiber strips.

2.5 FABRICATION

A. Embed anchors, inserts, plates, angles, and other items at locations indicated.

B. Provide openings required by other sections, at locations indicated.

C. Cut exposed ends flush.

D. Plant Finish: PCI MNL-116.

1. Floor Members: Finish B Grade.

2.6 FABRICATION TOLERANCES

A. Comply with PCI MNL-116 and PCI MNL-135, except as specifically amended below.

1. Maximum Variation From Nominal Dimensions:

a. Width: Plus or minus 1/4 in.

b. Length: Plus or minus 1/2 in.

c. Depth: Plus or minus 1/4 in.

2. Maximum Variation From Intended Camber: Plus or minus 1/4 inch in 10 feet.

3. Maximum Variation from Plan End Squareness: Plus or minus 1/4 in.

4. Maximum Sweep: Plus or minus 1/4 in.

5. Maximum Misalignment of Anchors, Inserts, Openings: Plus or minus 1/8 inch.

6. Maximum Bowing of Members: Length/360.

7. Maximum Bowing of Members: Plus or minus 1/4 inch in 10 feet to a maximum of 3/8 inch.

2.7 SOURCE QUALITY CONTROL

A. See Section 03 30 00 for testing of concrete and grout, materials, and mix designs.

B. Produce planks in accordance with requirements of PCI MNL-116. Maintain plant records and quality control program during production of precast planks. Make records available upon request.

1. Maintain one copy on project site.

C. Inspect and test stressing tendons before delivery for compliance with specified standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that site conditions are ready to receive work and field measurements are as indicated on shop drawings.

3.2 PREPARATION

A. Prepare support devices for the erection procedure and temporary bracing.

3.3 ERECTION

A. Erect members without damage to structural capacity, shape, or finish. Replace or repair damaged members.

B. Install bearing pads and sill seal at bearing ends of planks as indicated.

C. Align and maintain uniform horizontal and end joints, as erection progresses.

D. Maintain temporary bracing in place until final connection is made. Protect members from staining.

E. Adjust differential camber between precast members to tolerance before final attachment and grouting.

F. Secure units in place. Perform welding in accordance with AWS D1.1/D1.1M.

G. Make plank-to-plank joints smooth using grout, troweled smooth. Transition differential elevation of adjoining planks with grout to a maximum slope of 1:12.

3.4 TOLERANCES

A. Erect members level and plumb within allowable tolerances. Comply with PCI MNL-135, except as specifically amended below.

1. Plan Location from Building Grid Datum: Plus or minus 3/4 in.
2. Top Elevation from Building Elevation Datum at Plank Ends: Plus or minus 1/2 inch.
3. Maximum Jog in Alignment of Matching Ends: Plus or minus 1/2 inch.
4. Exposed Joint Dimension: Plus or minus 3/8 inch.
5. Differential Top Elevation As Erected: Plus or minus 3/8 inch.
6. Bearing Length in Span Direction: Plus or minus 3/8 inch.
7. Differential Bottom Elevation of Exposed Planks: Plus or minus 3/16 inch.

3.5 PROTECTION

A. Protect members from damage caused by field welding or erection operations.

B. Provide non-combustible shields during welding operations.

3.6 CLEANING

A. Clean weld marks, dirt, and blemishes from surface of exposed members.

END OF SECTION 03 41 13

SECTION 03 52 16 LIGHTWEIGHT INSULATING CONCRETE DECK SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. It is the intent of this Section,
   1. to include the metal decking, lightweight insulating concrete, and EPS roof insulation, and
   2. that all Work be performed by the lightweight insulating concrete Sub-contractor.

1.3 RELATED WORK

A. All Sections of Work pertinent to the roofing system, including mechanical, plumbing and electrical items penetrating metal deck, lightweight insulating concrete, roof insulation, and subsequent roofing.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.

B. Mix Design: Indicate materials and proportions of proposed mix.

C. Applicator’s Qualifications: Refer Paragraph 1.5, A.

D. Certifications:
   1. Manufacturer’s affidavit that materials used in Project contain no asbestos.
   2. On completion of installation, furnish Architect with Certificate signed by a representative of the manufacturer and by the applicator stating that insulating concrete was prepared and applied in accordance with manufacturer's recommendations.
   3. Manufacturer’s certification that system meets UL-90 wind up-lift and UL Class A fire rating.

1.5 REFERENCES

A. Comply with all applicable recommendations of the referenced standards. In any conflict between referenced standards, the more stringent requirements shall govern.
   1. American National Standards Institute/Underwriters’ Laboratories, Inc. (ANSI/UL)
   2. ASTM International (ASTM)
      a. A525, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
      b. C150, Standard Specification for Portland Cement
      c. C332, Standard Specification for Lightweight Aggregates for Lightweight Concrete

d. C495, Standard Test Method for Compressive Strength of Lightweight Insulating Concrete
e. C796, Standard Test Method for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam
f. E119, Standard Test Methods for Fire Tests of Building Construction and Materials

3. Underwriters' Laboratories, Inc. (UL)
   a. Wind Uplift Class 90
   b. Fire Ratings - Class A

1.6 QUALITY ASSURANCE

A. Applicator:
   1. Approved in writing by manufacturer to install the lightweight insulating concrete deck system and which has been in business for at least five (5) years.
   2. Responsible for ensuring positive drainage.
   3. No ponding water will be acceptable.
   4. Perform water test prior to application of roof system. Architect will be present, so notify 24 hours in advance.

B. Agency Approvals: Provide products, execution, and material thickness to conform to the applicable code requirements for the required fire resistance ratings, wind uplift classifications, insulation values, and diaphragm values.

C. Diaphragm Construction: Incorporate metal decking thickness, welding pattern, and minimum compressive strength of the lightweight insulating concrete to achieve diaphragm design values for edge and field conditions as specified to meet applicable code requirements.

D. Fire Resistance Classifications: Provide a lightweight insulating concrete system meeting the following fire resistance standards:
   1. Tested by UL in accordance with the procedures of ASTM E119 and listed in the UL "Fire Resistance Directory".
   2. Approval Rating: Class A

E. Wind Uplift Classifications: Provide a lightweight insulating concrete system meeting the following wind uplift standards:
   1. Tested by UL in accordance and listed in the UL "Roofing Materials Directory" for wind uplift resistance.
   2. Approval Rating: UL-90

F. Inspection and Testing Laboratory Services:
   1. Test results shall meet or exceed established Standards. Refer to Section 01 45 23, Testing and Inspecting Services.
   2. The Owner will select the Inspection and Testing Laboratory and pay for the cost of tests to determine the dry density and compressive strength.
   3. Compressive strength shall be determined in accordance with ASTM C495.
   4. Test cellular concrete in accordance with ASTM C796.

G. Building/Construction Components: Meet or exceed established standards.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened packaging fully identified as to manufacturer, brand or other identifying data as approved in submittal documents.

B. Store materials under cover, and in a dry location until ready for installation. Roofing insulation must always be covered or stored in a dry area when not being used.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload the structure.

D. Familiarize every member of the installation crew with the manufacturer's material safety data sheets and with fire and safety regulations recommended by OSHA, NRCA, and as required by governing codes of authorities having jurisdiction.

1.8 PROJECT / SITE CONDITIONS

A. When air temperatures of 40 degrees F or above are predicted to occur within the first 24 hours after placement, normal installation procedures may be used.

B. Do not install lightweight insulating concrete system when air temperatures are below 40 degrees F, including wind chill.

1.9 SEQUENCING AND SCHEDULING

A. Sequence, schedule and coordinate placement of lightweight insulating concrete roof insulation with work in other sections so as not to interfere with efficient roof insulation application.

1.10 WARRANTY

A. Manufacturer's Warranty: Warrant the decking and associated Work in conjunction with the roofing manufacturer from the project date of Substantial Completion as follows:
   1. The warranty shall be a NDL "No Dollar Limit" / no penal sum type, with total replacement cost. Refer to roof system specification section for length of warranty period.
   2. The warranty shall provide manufacturer's maximum extended wind rated coverage (up to Hurricane force winds) as defined by the Beaufort Scale.
   3. The warranty shall guarantee the entire roof system and associated work against defective materials and workmanship of installation, with NO exclusion for ponding water.
   4. The full system warranty including lightweight insulating concrete deck, roofing insulation, flashing, metal work, labor, and material shall be guaranteed against failure of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.

B. Contractor Warranty: Jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the lightweight insulating concrete deck will be and remain in good condition for a five (5) year warranty period, after the Architect accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the Contractor, and subcontractors, to make good the requirements of the warranty.

C. Make arrangements with the roofing manufacturer to provide the required warranty. Final warranty shall be submitted to Owner at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Products and manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications, and comply with Division 1 requirements regarding substitutions to be considered. See below.

2.2 MATERIALS

A. Metal Deck: Refer to Section 05 31 00. Corrugated steel decking incorporating a pre-applied galvanized coating conforming to ASTM A653, minimum Class G-90 and having slots in flutes equal to a minimum of 0.75 percent of the deck area. Refer to Structural Drawings for size, type and section modulus of metal deck and for welding pattern of deck.

B. Insulation Board:
1. Thickness: 6 inches thick typically, unless shown otherwise. Type I EPS
2. Approved Products/Manufacturers:
   a. "Insulperm" manufactured by Siplast, Irving, Texas (800) 922-8800.
   b. “Starrfoam-HB” manufactured by Starrfoam Manufacturing, Inc., Fort Worth, Texas (817) 654-4688.
   d. “Holey Board” manufactured by Houston Foam Plastics, Houston, Texas, (713) 224-3612.

C. Any one (1) of the following products from a single manufacturer is approved for use on this Project:
1. Cellular: With Cellular Mix:
   a. Wet Density: 33 to 49 lb./cu. ft. when tested according to ASTM C138.
   b. Air-Dry Density: 27 to 39 lb/cu.ft., when tested according to ASTM C 495.
   c. Compressive Strength: Minimum **300** psi when tested according to ASTM C 495.
2. Basis manufacturer: Celcore
3. Approved Substitutions:
   a. Prior to bid with associated tested assembly from roofing membrane manufacturer.

D. Cement: Portland type, conforming to ASTM C150, Type I or III.

E. Admixtures: Air entraining types and superplacticizer (water reducer) types as recommended by insulating concrete material manufacturer. Admixtures may be injected into material at the plant. The use of calcium chloride is not permitted.

F. Water: Potable water that is clean and free of deleterious amounts of acid, alkali, and organic materials – (Drinkable).

G. Expansion Joint Material: One (1) inch thick of type recommended by insulating concrete material supplier for expansion joints in structural system.

H. Reinforcing: 3/4 inch long, polypropylene fiber, Fibermix as manufactured by Fibermesh Co. for cellular concrete only.

H. Nailers: (Refer to Section 06 10 00, Rough Carpentry) As shown on drawings. Install required thickness of wood to align with specified thickness of lightweight insulating concrete.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Prior to erection of forms, inspect structural supports to ensure that they are secure and in place.

B. Prior to placing insulating concrete, inspect corrugated metal forms to ensure that they are secured to the structure and free of debris or foreign materials.

C. Notify other trades of dates of pouring in ample time for each to install his work.

3.2 INSTALLATION

A. Metal Deck: Place sheets with corrugation edges upon the perpendicular to supports with end laps centered over supports. Attach to supports with plug welds through welding washers. Refer to Structural Drawings for additional requirements.

B. Expansion Joint Material: Install at the following locations.
1. Perimeter of deck.
2. Changes in direction of roof deck.
3. Structural roof penetrations and expansion joints

C. Provide equipment and installation procedures conforming to the materials manufacturer’s installation instructions.

D. Mix Portland cement and aggregate in a mix ratio design with water in accordance with manufacturer’s instructions to achieve the specified wet density, minimum dry density, and minimum compressive strength.

E. Install slurry coat of lightweight insulating concrete over metal deck to minimum thickness of 1/4 inch over top of flutes of metal decking.

F. Place insulation boards into slurry within 30 minutes of applying lightweight insulating concrete in accordance with manufacturer’s instructions.

G. Walk board into slurry to ensure proper embedding of insulation boards into lightweight insulating concrete and keying with insulation holes. Hold boards back two (2) inches from all penetrations and perimeter. Place boards with staggered joints in running bond pattern.

H. Fill holes in the insulation boards and place a two (2) inch minimum thickness of lightweight insulating concrete over top of the insulation boards within four (4) hours after installation of insulation boards. Build all crickets and saddles shown with lightweight insulating concrete sloped to drain as indicated on drawings.

I. Deposit insulating concrete fill and screed (without troweling, rodding, tamping, or vibrating) immediately after mixing. Place on surfaces clean and free of loose matter. Place no concrete when temperature is 40 degrees F or falling.

J. All wood blocking for deck penetrations support and low roof deck to rise wall blocking shall be installed one (1) inch higher than designed lightweight fill thickness. Install fill in a two (2) foot tapered edge condition.

K. Allow insulating concrete fill to dry as thoroughly as possible before application of roofing, and not less than the minimum time recommended by the manufacturer. Begin roofing when the insulating concrete fill can withstand construction traffic (usually two (2) to three (3) days after placement), verify/confirm with manufacturer's recommendations. Do not leave insulating concrete fill deck surface exposed for longer than ten (10) days. Install no more insulating concrete fill than can be roofed within the ten (10) day time limit.

L. Where material is to be pumped, equipment shall be in good condition and well maintained to avoid equipment failure and delays.

M. Install and cure lightweight insulating concrete in accordance with manufacturer's instructions.

N. Avoid roof-top traffic over the lightweight insulating concrete deck system until 24 hours have elapsed after last placement of lightweight insulating concrete.

O. Allow lightweight insulating concrete to dry as thoroughly as possible before application of roofing. Testing Laboratory may perform tests to determine moisture content of lightweight insulating concrete.

P. Add two (2) pounds of fiber reinforcing per cubic yard of lightweight insulating concrete if cellular concrete is used.

3.3 FIELD QUALITY ASSURANCE

A. The Owner will select the independent inspection and testing laboratory and pay for the cost of tests in accordance with Division 1.

B. The independent inspection and testing laboratory will randomly sample and verify the following:
1. Mix design compressive strength in accordance with ASTM C495.
2. Mix design wet and dry density range in accordance with ASTM C495.
3. Polystyrene insulation density in accordance with ASTM C578.
4. Base ply fastener pull tests shall be performed three (3) days or more following the installation of the lightweight insulating concrete to ensure a minimum withdrawal resistance of 40 pounds per fastener. Submit test results to Architect.
5. Thermal insulation value in accordance with ASTM C177

C. Retests for work which fail initial tests or inspections shall be paid by contractor.

D. Results of all tests will be made available to all concerned parties.

E. Water Test: Run water on the finished deck for the Architect's observation. The lightweight insulating concrete shall slope to drain and no ponding of water will be accepted. Also, no slopes less than 1/4 inch per foot will be allowed.

F. Certification: On completion of installation, furnish Architect with certificate signed by a representative of the manufacturer and by the applicator stating that insulating concrete was prepared and applied in accordance with manufacturer's recommendations.

3.4 CLEANING

A. Remove equipment, excess materials, debris, and trash at the completion of installation of the lightweight insulating concrete deck system.

B. Remove visible lightweight insulating concrete from underside of metal deck where it is exposed to normal view.

C. Wash floors below the lightweight insulating concrete deck system after each days installation or as necessary and remove wash water.

3.5 PATCHING AND REPAIRING

A. Perform all patching and repairing of lightweight insulating concrete using the same materials specified in this Section or materials approved by the system manufacturer.

B. The party responsible for damage will be charged for repairs.

3.6 PROTECTION

A. Lightweight insulating concrete installer shall be responsible for protecting newly applied decks from all adverse conditions until Roofing Contractor begins installation of specified roof system.

B. General Contractor shall be responsible for protection of roof deck from other trades until it has been approved for traffic by installer.

END OF SECTION

SECTION 04 20 00 UNIT MASONRY

PART 1 – GENERAL

1.01 SCOPE

A. Furnish all materials, equipment, scaffolding, and labor to install all masonry shown on drawings and specified herein. Install equipment, anchors, vents and devices furnished by other trades.

B. Section Includes:

1. Face brick
2. Concrete Masonry Units
3. Masonry joint reinforcement
4. Ties and anchors
5. Embedded flashing
6. Miscellaneous masonry accessories
7. Mortar and Grout

1.02 REFERENCES

A. The Masonry Society:

1. TMS 402 - Building Code Requirements for Masonry Structures.
2. TMS 602 - Specifications for Masonry Structures.

B. ASTM International:

1. ASTM A82/A82M - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A 153/A 153M - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
3. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
5. ASTM A580/A580M - Standard Specification for Stainless Steel Wire.
6. ASTM A641 - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
7. ASTM A951 - Standard Specification for Steel Wire for Masonry Joint Reinforcement
8. ASTM A1064 - Standard Specification for Steel Wire for Masonry Joint Reinforcement
9. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale).
10. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile.
11. ASTM C90 - Standard Specification for Load bearing Concrete Masonry Units.
12 ASTM C91 - Masonry Cement.
13. ASTM C94 - Ready-Mixed Concrete.
14. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
15. ASTM C144 - Aggregate for Masonry Mortar.
16. ASTM C150 - Portland Cement.
17. ASTM C207 - Hydrated Lime for Masonry Mortar.
18. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale).
19. ASTM C270 - Mortar for Unit Masonry.
20. ASTM C404 - Aggregates for Masonry Grout.

21. ASTM C476 - Grout for Masonry.
22. ASTM C780 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
23. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.

24. ASTM C1019 - Method of Sampling and Testing Grout
25. ASTM C1364 - Standard Specification for Architectural Cast Stone.
26. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
27. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

C. National Fire Protection Association:
1. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

D. Underwriters Laboratories Inc.:
1. UL723 - Tests for Surface Burning Characteristics of Building Material.

1.03 GENERAL REQUIREMENTS

A. A thoroughly competent masonry foreman shall be in charge of masonry Work at all times during construction

B. Masonry Work shall not be done when temperature is below 40°F. and dropping or when freezing temperatures are forecast within 72 hours.

C. Scaffolding: Shall safely support Workmen and all necessary materials and equipment.

D. “Concrete Masonry Handbook” by the Portland Cement Association shall provide minimum standards required for concrete masonry.

E. Protect all materials from damage; store masonry, cement, lime off of ground.

F. Construct 4’ x 4’ sample panel of each type of masonry to show masonry, pattern, and joints for Architect and Owner’s approval prior to start of masonry Work. If necessary, repeat constructing sample panels until one is approved for each type of masonry Work. Comply with structural notes on Drawings.

H. Exterior concrete masonry units to have “Acme Shield” or “Dry Block” or approved equal waterproofing additive. Coordinate with mortar admixture for proper bond.

I. Build-in all thru-wall flashing as indicated in Plans, Details, Specification Sections 07 62 00 and 07 65 26 and as required for complete water tight installation. Verify complete coverage of dampproofing prior to installation of masonry materials.

1.04 SUBMITTALS

A. Section 01 33 01 – Submittal Procedures: Submittal requirements.

B. Product Data:
1. Submit data for masonry units, fabricated wire reinforcement, wall ties, anchors, cavity drainage material, and other accessories.
2. Submit data for cleaning solutions, including detailed description of methods, materials, equipment and site cleanup procedures to be used. Provide with letters of approval from brick and cleaning material manufacturers regarding the compatibility of proposed use of products together for cleaning purposes.

C. Samples:
   1. Submit sample of each type of masonry unit and face brick, to illustrate color, texture and extremes of colors range. Furnish additional samples when necessary to fully illustrate the complete range of highly variable materials.
   2. For Brick Veneer Unit Color selection prior to Mock-Ups: Contractor shall furnish any colors/blends listed in Para. 2.02B ***and*** current “brick boards” that illustrate the full color offerings available (see Para. 2.02B). Architect shall select colors for the Contractor to make available in Color Selection Mock-ups (refer to Para. 1.07B); note that multiple colors may be selected for mock-up.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Mortar and Grout:
   1. Submit two (2) copies of proposed mortar and grout mix designs to Owner's testing laboratory.
   2. Submit mix design for mortar indicating whether the proportion or the property specification of ASTM C270 is to be used.
   3. Submit mix design for grout indicating conformance of grout to requirements of ASTM C476.
   4. Submit test reports of preconstruction tests of mortar for consistency, mortar aggregate ratio, water content, air content, and compressive strength in conformance with ASTM C780.
   5. Submit test reports of grout tests in conformance with ASTM C1019.
   6. Submit Manufacturer’s certification for products indicating conformance with specified requirements.
   7. Submit two boxes of full range mortar color offerings for Architect to select from; multiple colors may be selected.

F. Cleaner, Sealer Applicator Qualifications: Submit qualifications of applicator.
   1. Certification stating applicator is experienced in the application of the specified products.
   2. List of recently completed masonry cleaning projects, including project name and location, names of owner and architect, description of cleaning products used and substrates, applicable local environmental regulations, and application procedures.

G. Environmental Regulations: Submit description for testing, handling, treatment, containment, collection, transport, disposal, and discharge of hazardous wastes and cleaning effluents. Describe any hazardous materials to be cleaned from substrates. Submit applicable local environmental regulations.

H. Protection: Submit description for protecting surrounding areas, landscaping, building occupants, pedestrians, vehicles, and non-masonry surfaces during the work from contact with masonry cleaners, residues, rinse water, fumes, wastes, and cleaning effluents.

I. Surface Preparation: Submit description for surface preparation of substrates to be completed before application of masonry cleaners, sealers and graffiti control.

J. Application: Submit description for application procedures of masonry cleaners, sealers and graffiti control products.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with TMS 402 - Building Code Requirements for Masonry Structures and TMS 602 - Specifications for Masonry Structures except where exceeded by requirements of the contract documents.

B. Fire Performance Characteristics: Where indicated or required, provide materials and construction which are identical to assemblies whose fire endurance has been determined by testing in compliance with ASTM E119 by U.L. or other recognized testing and inspection organization or by other means, acceptable to authority having jurisdiction.

C. Masonry Cleaning: Workers shall have minimum 5 years of masonry cleaning experience, and shall be approved by cleaner manufacturer prior to application of cleaning material, and shall meet with cleaner manufacturer for demonstration and instruction s for use of product prior to application.

D. Single Source Responsibility:
1. For Masonry Units: Obtain masonry units of uniform texture and color, or a uniform blend within the accepted ranges for those characteristics, from one (1) manufacturer and one (1) production plant for each different product required for each continuous surface or visually related surfaces.
2. For Mortar and Grout Materials: Brands of cementitious materials and admixtures, and the source of supply of sand and aggregates shall remain the same throughout the Work where exposed to view and where not scheduled to receive a subsequently applied finish, i.e. parging, painting, etc., unless directed otherwise in writing by the Architect.
3. Contractor's Responsibility: Contractor performing Work of this Section shall be responsible for coordinating with others performing work which is built-in or adjacent to unit masonry work.

E. Masonry Cleaner & Sealer Qualifications:
1. Manufacturer Qualifications:
   a. Manufacturer capable of providing field service representation during installation and who will approve the installer and application method.
2. Installer Qualifications:
   a. Installer experienced in performing this type of work and who has specialized in work similar to the type required for this project.

F. The finished masonry surface will in many cases be the finished wall surface in the room it defines. The aesthetic value of the masonry installation is paramount. Consistent mortar color, joint width and texture, uniformity of masonry surfaces and coloring are all qualities to be judged. Cull units with chips or cracks which exceed allowable defects under product standards. Turn chipped faces toward cavity spaces or chases with unchipped faces exposed to occupied spaces. Uniformly distribute chipped units that are visible within the finished wall.

G. Continuously monitor quality of installation and remove and replace non-conforming work immediately.

1.06 QUALIFICATIONS

A. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.07 MOCKUP

A. Each type of masonry used shall be represented by mockup prior to approval of masonry work to begin. Do not begin masonry work until Architect has approved mockup.

B. COLOR SELECTION MOCK-UP: To be conducted prior to Cavity Wall mock-up (described in 1.07C-E) for the purposes of ***brick veneer and mortar color selection only***.
1. Upon Architect's prior selection of brick veneer color units (per Para. 1.04.C.2), Contractor shall provide full brick units for Architect to complete overall Project color selections and to conduct dry-stack brick mock-ups. Separate dry-stack mock-ups may be required for each brick color/pattern (as noted on exterior elevation legend), plus any other freestanding element with brick veneer (dumpster enclosure, masonry low walls, etc.).
2. Mock-ups shall be located adjacent to each other, and in a location that has sufficient sunlight. Contractor shall coordinate with the Architect on locations of mock-ups.
3. Mock-ups shall be composed of sufficient units to achieve an approximately 2' wide x 2' tall composition.
4. After review and approval by Architect and Owner, Contractor may remove mock-up from the construction area and commence with Cavity Wall Mock-up (see Section C below) – Contractor to confirm which approved color composition shall be used on the Cavity Wall mock-up.
5. Units from each approved color composition shall be kept onsite as a basis for acceptable color tone/range.

C. **CAVITY WALL MOCK-UP**: Construct cavity masonry wall mockup, **8' wide x 6' tall**, to include masonry, mortar and accessories, structural backup, flashings, wall insulation, and weeps. Include a window to demonstrate flashing and window installation. Coordinate with Architect on the window type to include in the mock-up. Coordinate location of mock-up with Architect prior to proceeding.
1. Include a sealant-filled control joint.
2. Omit masonry above flashing to leave a 12-inch length of the flashing exposed to view.
3. Illustrate all agreed-upon masonry unit colors, face textures, mortar color, blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
   a. One approved color selection (see Item B above) may be used in the Cavity Wall Mock-up at the approval/discretion of the Architect.
4. Clean face of mockup with masonry cleaner using methods anticipated for the work.
5. Refer to the Drawings for mock-up diagram and specifics.

D. Furnish removable cover to protect completed mock-up from rain or other environmental or site conditions that may after its appearance.

E. Coordinate location and orientation for mockup panels with Architect in location for mockup panels to remain until all masonry work in complete.

F. Remove mockup only when directed by Architect.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

B. Handle and store ceramic glazed masonry units in protective cartons or trays. Do not remove from protective packaging until ready for installation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather Requirements: In accordance with ACI 530.1/ASCE6/TMS 602 when ambient temperature or temperature of masonry units is less than 40 degrees F.

B. Hot Weather Requirements: In accordance with ACI 530.1/ASCE6/TMS 602 when ambient temperature is greater than 100 degrees F or ambient temperature is greater than 90 degrees F with wind velocity greater than 8 mph.

C. Bracing of Work in Progress:
1. Where masonry erection may be exposed to high winds, installation shall be adequately braced until masonry construction has attained sufficient strength to resist wind forces.
2. Shores and forms shall not be removed until masonry construction has attained sufficient strength to support its own weight and all other construction or environmental loads.

1.10 COORDINATION

A. Coordinate work with work of other trades built into or adjoining masonry work.

B. Openings and chases for heating, plumbing, electrical ducts, pipes, and conduits shall be built into masonry walls as required. Provide for installation of bolts, toggles, flashings, beams, anchors, hangers, nailing strips, wall plugs, and frames as required. Consult other trades in advance and make provisions for installation of their work to avoid cutting and patching. Coordinate installation of steel reinforcement for reinforced masonry. Coordinate placement of concrete in masonry beams, lintels, soffits, and pilasters.

C. Contractor performing Work of this Section shall be responsible for, and coordinate with, work of Section 07 11 13 - Bituminous Dampproofing, Section 07 65 26 – Membrane Flashing and all other Sections of Work built-in, adjacent to, or applied to unit masonry work.

1.11 WARRANTY

A. Warrant the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

C. Noticeable deterioration of unit or mortar finish.

D. Chalking or dusting excessively.

E. Changing color in irregular fashion.

F. Cracking or spalling.

G. Releasing from substrate.

H. Staining or discoloring, including efflorescence.

PART 2 - MATERIALS

2.01 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.02 BRICK

A. Meet or exceed ASTM C216, Type FBS, Grade MW

B. BRICK VENEER (BK1, BK2, BK3

1. Brick shall be as manufactured by:
   Upchurch Kimbrough
   specialist@upchurchkimbrough.com
   a. Substitutions: Refer to section 01 25 13.
   a. Final selection of all colors will be conducted during the submittal and mock-up process. Architect shall make final selection as available from manufacturer's full range of colors. ***Multiple colors may requested to be mocked up and multiple colors may be selected.***

2. The body compositions shall be of the finest shales and clays producing a uniform dense body. Size shall be King Size. Provide actual samples of full color range for selection. Joint width shall be as specified and provided by template manufacturer. Mix bricks from several cartons for best shading during installation. Install and clean per manufacturers recommendations.

2.03 CONCRETE MASONRY UNITS

A. Shapes: Provide modular sizes and shapes as required, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.

1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. For all interior CMU walls (integral color, burnished and/or painted), all projecting 90° corners and wing walls shall have factory-prefinished manufactured integral bullnose block (***on-site field bullnosing by mechanical means will not be allowed***). Provide 1-inch radius unless noted otherwise on drawings.

B. STANDARD CONCRETE MASONRY UNITS: ASTM C-90, Grade N, Type 1, 2000 psi strength with a maximum linear shrinkage of 0.06 percent as determined by ASTM Test Method C-426. Lightweight aggregate (less than 105 PCF), high temperature, high pressure, steam cured or burned expanded clay or shale, all modular sizes and shapes necessary as manufactured by Featherlite Corporation or Headwaters Construction Materials.

2.04 MORTAR AND GROUT

A. Mortar: Solomon Colors, SGS Concentrated A, H, and X Series Mortar Colors; Architect to select color(s) to match CMU and brick; Mix and use according to manufacturers printed instructions.

B. Mortar Materials
1. Cementitious Materials:
a. Masonry Cement: ASTM C91, Type N, color as required to produce approved color sample.
b. Mortar Cement: ASTM C1329, Type N.
c. Portland Cement: ASTM C150, Type I, color as required to produce approved color sample.
d. Hydrated Lime: ASTM C207, Type S.
2. Sand: ASTM C144.
3. Water: Suitable for drinking, clean, and free of harmful amounts of acid, alkalis, salts, or organic materials.
4. Admixtures:
a. When required use only non-chloride based accelerators as approved by specifier
b. No antifreeze substances shall be added to the mortar.
c. Waterproofing admixture acceptable to masonry manufacturer. Dry-Block as manufactured by W.R. Grace or approved substitution.
5. Pigments for colored mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C 979.
a. Use of pigments shall not exceed 5% of the weight of masonry cement or 10% of the weight of Portland cement in the mortar.

C. Grout Materials
1. Portland Cement: ASTM C150, Type I.
2. Hydrated Lime: ASTM C207, Type S.
3. Aggregates: ASTM C404
4. Water: Suitable for drinking, clean, and free of harmful amounts of acid, alkalis, salts, or organic materials.

D. Mortar Mixes
1. Mortar: ASTM C270, Type N in conformance with proportion specifications.

E. Grout Mixes
1. Grout: ASTM C476, grout having 3,000 psi strength at 28 days for all reinforced masonry lintels, bond beams, and walls as indicated. See structural drawings for reinforced walls.

F. Water: Clean and potable

2.05 MISCELLANEOUS MATERIALS

A. Brick Weep Holes: Hohmann and Barnard, Inc. #343 Louvered PVC weep hole. Wire bond #3602 is an approved equal. Height and depth shall match masonry minus set back from face of brick recommended by manufacturer for each condition. Color as selected by Architect.

B. CMU Weep Holes: Hohmann and Barnard, Inc. #QV-Quadro-Vent, 3/8-inch Wide x 2 1/2-inch tall. Depth to equal depth of masonry less set back from face of masonry as recommended by manufacturer for each condition. Color as selected by Architect.

C. Cavity Wall Drainage System: Mortar net with 90% open mesh weave, 10" high trapezoidal-shaped. Provide one or more layers in thickness as required to fill cavity width.

D. Reinforcing steel: Reinforcing steel shall conform to ASTM A615, Grade 60. Refer also to specification Section 03 20.00 - Concrete Reinforcing. All manufactured steel is to be made in the USA.

E. Wire Reinforcement: Masonry joint wire reinforcement shall be galvanized steel conforming to ASTM A-641 for interior (dry) walls and ASTM A-153-B2 for exterior or damp walls. Wire reinforcement shall be fabricated in straight lengths of not less than 10 ft. Provide pre-fabricated matching corner ("L") and intersecting ("T") units.

Fabricate with 9-gauge side and cross truss type rods. Wire reinforcement shall be lapped at least 6" with at least one cross wire within the lap. Wire reinforcement shall be width required for proper embedment in wythes of masonry. All wire reinforcement shall be completely embedded in mortar or grout. Space not more than 16" o.c. vertically. Install according to IBC and ACI-530 recommendations.

AA Wire Products Company Numbers:

Single wythe CMU:	AA600
Brick with CMU backup:	AA625
Brick or split-face CMU with metal stud backup:	AA401CE anchor with AA400 W/T tie.
Double wythe brick or CMU walls:	AA602

Hohmann and Barnard, Inc.; Masonry Reinforcing Corp. of America (wire bond); National Wire Products Industries; and Heckman are approved manufacturers.

F. Masonry Anchors: Miscellaneous anchors, 6-gauge, 3/16" diameter or heavier gauge galvanized steel wire or 1" wide by 1/8" thick bar, adjustable, rectangular, triangular, or other approved anchors suitable for the job. Corrugated anchors and ties are not acceptable. Provide two-part ties as necessary to fit conditions. Space anchors not more than 16" o.c.e.w. At masonry wrapped columns, install a minimum of one anchor per side and space 16" on center vertically.

G. Control Joints:
1. Exterior Wall Joints: Extruded rubber similar to Hohmann and Barnard, Inc. RS Series, of applicable design to receive sealant to seal joints.
2. Interior Wall Joints: Employ closed cell rubber strip of 1" less than thickness of wall. Secure with thin bed of adhesive to masonry as wall is laid. Finish with a thick layer of paintable sealant. Paint wall joint same color as wall.
3. Sealant shall be as specified in Section 07 90 00.
4. Exterior building expansion joints shall be as specified in Section 07 95 13.

2.06 MASONRY CLEANING SOLUTIONS

A. All exterior and interior exposed finished masonry and stonework shall be cleaned based on the cleaning material schedule below.

B. Water: Clean, potable, and free of oils, acids, alkalis, salts, and organic matter. Use to rinse masonry surfaces and dilute concentrated cleaners.

C. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

D. Proprietary Acidic Cleaner: "Sure Klean" manufactured by ProSoCo, Inc., Lawrence, KS, (800) 155-4255, or Architect or Owner approved equal. Verify product use based on masonry color being cleaned as instructed by manufacturer.
1. Approved Manufacturers:
   a. Diedrich Technologies, Inc.
   b. EaCo Chem, Inc.
   c. ProSoCo, Inc.
   d. Substitutions: Section 01 25 13

E. Muriatic acid is not permitted.

F. The following products based on ProSoCo Sure Klean® products are intended as a guide only and does not preclude the contractors use of equal products by listed manufacturers. Consult manufacturer prior to application for any questions or inconsistencies.

Substrate	**Color/Type**	**Cleaning Solution**
Brick	Red	Sure Klean® 600 Detergent
	Light	Sure Klean® Vana Trol®
	Dark	Sure Klean® Vana Trol®
	Pavers	Sure Klean® 600 Detergent
	Glazed	Sure Klean® Vana Trol®
CMU	Split Face	Sure Klean® Custom Masonry Cleaner
	Burnished/Ground Face	Sure Klean® Burnished Custom Masonry Cleaner
	Glazed Face CMU	Sure Klean® Vana Trol®
Architectural Concrete	Natural Color/Smooth	Sure Klean® Light Duty Concrete Cleaner
	Textured	Sure Klean® Custom Masonry Cleaner
Stone Construction	Cast Stone	Sure Klean® Light Duty Concrete Cleaner
	Arriscraft/ Synthetic Stone	Light Staining - Sure Klean® Burnished Custom Masonry Cleaner Heavy Staining - Sure Klean® Vana Trol®
	Limestone (Unpolished)	Sure Klean® Vana Trol®

2.07 MASONRY SEALER, WATER REPELLENT AND GRAFFITI CONTROL MATERIALS

A. All exterior and interior exposed finished masonry and stonework shall be sealed based on the water repellent schedule below. All exterior and interior masonry shall be sealed full height of applied wall.

B. Masonry Sealer, Water Repellent and Graffiti Control: Products manufactured by ProSoCo, Inc., Lawrence, KS, (800) 155-4255, or Architect or Owner approved equal. Verify product use based on masonry color being cleaned as instructed by manufacturer.

C. Provide five (5) year written warranty for performance of product and application.

D. Use water repellent admixtures for masonry units, mortar and grout by a single manufacturer.

E. The following products based on ProSoCo products are intended as a guide only and does not preclude the contractors use of equal products by listed manufacturers (provided an approved substitution request has been obtained). Consult manufacturer prior to application for any questions or inconsistencies.

Substrate	**Type**	**Water Repellent**
Brick	Clay (Exterior)	Weather Seal Siloxane PD
CMU	Split Face	Weather Seal Blok-Guard & Graffiti Control
	Interior Integral Color	Sure Klean® Burnished Block Sealer
Stone Construction	Natural Stone	Weather Seal Natural Stone Treatment WB
	Manufactured Stone	Weather Seal Siloxane PD
Burnished Block	Exterior	Weather Seal Blok-Guard & Graffiti Control
	Interior	Sure Klean® Burnished Block Sealer

PART 3 – EXECUTION

3.01 FORMS AND SHORES

A. Provide forms and shores sufficiently strong and rigid as required to support soffits, beams, and lintels during construction.

B. Build forms to conform to shape, line, and dimension of masonry members as detailed, substantial and sufficiently tight to prevent leakage of mortar, grout or concrete. Properly brace or tie together so as to maintain position and shape.

3.02 PREPARATION OF MATERIALS

A. Brickwork: Dampen brick before laying in a manner consistent with the nature of the brick, the mortar, and the weather conditions.

B. Mortar Mixing:
1. Measure sand by volume or equivalent weight using suitable containers for material measurement. Measuring sand by the shovel is not acceptable.
2. In a clean mortar mixer, thoroughly mix ingredients for a minimum of five (5) minutes with maximum amount of water to produce proper workability.
3. Retemper mortar as needed within 2 1/2 hours after initial mixing.
4. Discard unused mortar 2 1/2 hours after initial mixing.
5. Mortar shall not be used if curing has progressed to yield a stiff consistency.

C. Grout Mixing:
1. Control batching procedure to ensure proper volume proportions of grout materials and achieve grout slump between 8 and 11 inches.
2. Mix grout in accordance with ASTM C94.
3. Consistency shall completely fill all spaces intended to receive grout.
4. Grout shall not be used if curing has progressed to yield a stiff consistency.
5. Measure grout materials mixed at job site by volume or equivalent weight using suitable containers for material measurement.
6. In clean a mechanical mixer, thoroughly mix ingredients for a minimum of five (5) minutes.

D. Mortar and Grout Testing:
1. Test mortar and grout in accordance with Section 01 45 29.
2. Testing of Mortar: In accordance with ASTM C270.
3. Testing of Grout: In accordance with ASTM C1019.

E. Reinforcement:
1. Reinforcement shall be free from loose rust and other coatings that would reduce the bond.
2. Cut accurately to length and bend by such methods as will prevent injury to the material.
3. Straighten out kinks or bends.

F. Flashing:
1. Locations: Install in exterior walls to divert moisture within walls to exterior surfaces.
2. For membrane flashing, install per specification Section 07 65 26 and as indicated within the Drawings.
3. For sheet metal flashing, install per specification Section 07 62 00 and as indicated within the Drawings.
4. Adjacent Work: Protect work by masking, covering, or other precautionary methods. Remove protection when no longer necessary.
5. Separate stainless steel flashing from dissimilar materials as required.
6. Protect membrane flashing from overexposure to direct sunlight.

3.03 PROCEDURE

A. Install mortar and grout in accordance with ACI 530.1/ASCE 6/TMS 602.

B. Mortar proportions (by volume): **Type "N"** (750 psi compressive strength)
1 part portland cement
1/2 part hydrated lime
3 1/2 to 4 1/2 parts sand

1. Mix mortars with minimum amount of water consistent with workability to provide maximum tensile bond strength with capacity of mortar.

2. Materials shall be accurately measured and shall be mixed in a power mixer for a period of not less than five (5) minutes after all materials have been placed in mixer. Materials must be consistently the same from same source throughout the job. Tools and mixing boxes must be kept clean and no mortar which is partially set shall be retempered for use.

3. If required, add mortar color to mortar mix as required to match architect selected sample. Use white Portland cement at light-face CMU.

4. Masonry contractor will be responsible to ensure mortar meets or exceeds applicable UL assembly requirements and shall notify Architect & Structural Engineer of any conflicts prior to commencement of work for any modifications required.

B. Lay exposed masonry in the bond pattern shown or, if not shown, lay as follows:
1. Coursing of Concrete Masonry Units:
   a. Bond: Running (unless otherwise shown on the drawings).
   b. Coursing: One unit and one mortar joint to equal 8 inches.
   c. Mortar Joints: Concave (excluding exterior cavity wall side)
   d. Cavity wall Mortar Joints: Flush with no irregularities exceeding ¼-inch.
2. Coursing of Brick Units:
   a. Bond: Running (unless otherwise shown on the drawings).
   b. Coursing: Three units and three mortar joints to equal 8 inches.
   c. Mortar Joints: Concave and Flush

3. Lay solid masonry units in full bed of mortar, with full head joints

4. Units shall be laid with a shove joint on full, evenly-spaced bed and head joints fully coated with mortar before laying.

5. Buttering corners of joints or excessive furrowing of mortar joints are not permitted. Remove excess mortar as work progresses.

6. Interlock intersections and external corners. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.

7. Perform job site cutting of masonry units with motor-driven saws to assure straight, clean, unchipped edges. Prevent broken masonry unit corners or edges. Where possible, use full-size units without cutting.
   a. At all louver and/or window sill conditions, grind down outside edge of brick as required to provide positive drainage of subsill. Provide a minimum of 1/4-inch drop from face of window framing system and or louver frame, to the outside face of the brick veneer.

8. Install cut units with cut surfaces and edges concealed.

9. Select and arrange exposed units to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

10. Cut mortar fins protruding into cavity from back side of face brick as work progresses.

11. Isolate masonry from vertical structural framing members.

12. At full-height walls, leave a 1" space between top of masonry and floor or roof structure above. Brace masonry from structure with 16- gauge galvanized steel angles having 4" equal legs and 8" lengths mechanically anchored to the floor or roof structure and spaced not more than 4'-0" on center or as indicated on Structural Drawings.

13. Isolate top of masonry from horizontal structural framing members and slabs or decks with compressible joint filler.

C. All masonry walls shall be bonded at corners and anchored to connecting Work. Appropriate anchors are to be used for each condition, including but not limited to, CMU, structural framing, and sheathing over metal studs; minimum 3 anchors plus floor anchor at each jamb of door frames and windows.

D. Joints shall be of uniform width throughout. Horizontal joints shall be level and vertical joints shall align.

E. Horizontal and vertical joints shall be 3/8" wide. Strike uniformly with 1" diameter jointing tool to smooth, hard, dense concave finish and left without cracks between mortar and units. Delay tooling joints until mortar has had time to initially set. Texture and finish of all joints shall be the same.

1. Tool both sides of masonry units
2. Tool all joints, whether exposed to view or not, except as follows:

   a. Walls receiving an applied resilient base shall have the joints of the first course of masonry tooled flush with face of masonry

   b. Walls receiving damproofing and/or waterproofing finish shall have the joints for the entire height of masonry tooled flush with face of masonry.

   c. Walls receiving tile finish shall have the joints struck flush for the full extent of area receiving the scheduled finish.

   d. Whenever scored CMU is used, do not grout score and tool grout with raked joint to match score to accentuate 8 x 8 pattern.

F. Provide masonry reinforcement as indicated by Item 3.07.

G. No wet concrete masonry units shall be laid; wet face brick 3 to 4 hours before laying.

H. Adequately brace all walls so that wind and other forces will not damage wall.

I. Over openings, provide CMU lintel block concrete filled with reinforcing as shown on plans (minimum two (2) #5 continuous steel reinforcing bars and extend minimum 8" each side of opening). Install steel lintels at locations as required. Provide continuous concrete filled steel reinforced bond beams; reinforcing shall not cross expansion joints.

J. Reinforce CMU walls with filled cells and rebar embedded in foundation as indicated in Structural drawings, Specifications, and details.

K. Provide weeps 8-inches from each end and at 24-inches on center in the base course, TOP COURSE and at ALL through-wall flashing of exterior wythe of all exterior walls including all lintels and sills. Install in accordance with manufacturers written instructions. Care shall be taken to keep openings free from blockage by construction debris, backfill, etc.

L. Provide continuous cavity wall drainage system at ALL thru wall flashing conditions, base of exterior walls, etc. to maintain airflow and drainage while suspending mortar at unequal heights. Install per manufacturer's instructions.

3.04 EXPANSION AND/OR CONTROL JOINTS

A. Provide expansion joints and/or control joints in all interior and exterior masonry walls at locations as shown on drawings, or as specified below, 3/8" to 1/2" wide unless otherwise noted

1. In long, straight walls at 15'-0" o.c. max., or height of the wall, whichever is less
2. At all abrupt changes in wall thickness or height
3. At chases for pipes, fixtures, etc.
4. On each sides of wall openings (or lintels above openings)
5. At bond beam breaks
6. At abutment of walls and columns or pilasters
7. At wall intersections in main walls or partitions (including all locations where interior CMU walls frame into exterior/perimeter CMU walls)
8. At construction joints in foundations, roofs or floors
9. At return angles in "L," "T" or "U"-shaped structures
10. When brick or stone veneer is applied to block
11. Within 2 feet 8 inches of building corners
12. On each side of all exterior door and window heads
13. On one side of all interior door and window heads

B. Steel Lintels: Provide horizontal bond breaks at the end bearing to allow for thermal expansion and contraction and provide control joints on each side of the opening continuing to the top and bottom of the brick wythe

C. CMU Lintels: Provide control joints in alignment with the outside ends of the lintel continuing to the bed joint and then with horizontal bond breaks at the end bearing

D. At exterior walls, joints in CMU shall be located directly behind joints in brick.

E. All Control and/or Expansion joints shall be free of mortar.

F. Exterior control and expansion joints shall be weatherproofed at the exterior surface with sealant over backer rod to match masonry or stone color. Interior joints shall be filled with caulk over backer rod. At exterior expansion joints provide copper bellows expansion joint material at the back-up wall condition as per Drawings.

G. At corridors and fire-rated walls, install fire-rated caulk according to manufacturer's printed instructions to maintain fire rating of wall construction. See Specification Section 07 90 00, Building Sealants and Caulking. Provide bond breaker material at horizontal joints below CMU headers to allow movement in horizontal expansion joints without cracking masonry.

H. Veneer Construction: Provide horizontal pressure relieving joints beneath shelf angles as recommended by BIA Technical Note 28B current edition.

3.05 WORKMANSHIP

A. Exterior masonry shall be laid up to make walls absolutely watertight. Prior to start of any masonry work, contractor shall review all back-up surfaces to insure completeness of waterproofing job; membrane waterproofing shall be installed, joints taped and sealed, dampproofing complete, etc.

B. Full joints are mandatory, light furrow on bed only. Apply sufficient mortar on ends to fill end joints completely.

C. Lay masonry true, plumb, level and straight. Wide or narrow joints and out-of-square units will be rejected.

D. Build in all ancillary work, equipment, etc. in neat, workmanlike manner.

E. Build in thru-wall flashing and sheet metal work or accessories furnished by other divisions. All joints in flashing lapped at least 6" and sealed. Turn up sides of thru wall flashing at ends of run to create end dam. Provide positive slope toward weeps to avoid any ponding water on flashing.

F. See that proper provisions are made for all structural, mechanical and electrical; construct chases, recesses, openings, etc. Build in grounds, nailing boards, bolts, plates, etc. Set bucks, blocking and anchors. Set hollow metal frames with proper anchors; grout jambs full. Provide a minimum 2" clearance around all structural steel, columns, and beams. Provide appropriate size CMU furring blocks to accommodate this. Provide wall furr outs as required

to conceal structural columns, mechanical, electrical, etc. Refer to structural drawings, architectural drawings, mechanical/electrical drawings, as-built conditions, etc. for locations of these items.

G. Full size, uncut units shall be used whenever possible.

H. Openings and cutouts shall be carefully cut, formed or otherwise made around built-in items. Exterior brick veneer shall be turned in at window/door jamb conditions, unless noted otherwise on the Drawings.

I. Any unit that is disturbed after mortar has stiffened shall be removed and re-laid with fresh mortar.

J. Unfinished work shall be stepped back for joining with new work.

K. Concrete masonry unit lintels shall be formed from units of the thickness of the wall or proper height, cut or uncut, with the bottom of the unit at rough opening height and the top of the next adjacent mortar joint but not less than 8" in height.

L. Face of masonry units, texture, color, finish shall be the same in the entire wall surface in which they are laid.

M. For all interior CMU walls (integral color, burnished and/or painted), all projecting 90° corners and wing walls shall be factory-prefinished manufactured integral 1" radius bullnose block (on-site field bullnosing by mechanical means will not be allowed). Walls completely wrapped by hollow metal doorframes do not need to be bullnosed.

N. Take precautions to prevent excess mortar from dropping into cavity. Open cavities of walls under construction shall be covered at day's end.

O. If Work includes split face CMU, chip away uneven edges of CMU as necessary to install surface-mounted items flush with wall (i.e., cover plates, electrical cover plates, louvers, drinking fountains, fire alarm pulls, handrails, etc.).

P. Stain Prevention: As work progresses, prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

Q. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

3.06 JOINT REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement in CMU walls 16-inches on center vertically.

B. Place joint reinforcement in first and second horizontal joints above and below openings greater than 12 inches wide. Extend minimum 16 inches each side of opening.

C. Place joint reinforcement continuous in first and second joints below tops of walls. Lap joint reinforcement ends minimum 6 inches.

D. Cut or interrupt joint reinforcing at control and expansion joints.

E. At corners, install horizontal joint reinforcement with prefabricated 'L" intersections.

F. At intersecting and abutting walls, unless vertical expansion or control joints are shown at juncture, install horizontal joint reinforcement with prefabricated "T" intersections.

G. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

H. Install anchors attached to concrete and steel structural members:
1. Leave an open space not less than 1 inch in width between back of masonry and face of structural member. Keep open space free of mortar or other rigid materials.
2. Install anchors at maximum 16 inches o.c. vertically and horizontally.

I. Install Wall Ties at CFMF (Cold Formed Metal Framing) Stud Backup Walls:
1. Install wall tie anchor plates at 16 inches o.c. vertically and maximum 16 inches o.c. horizontally.
2. Coordinate anchor plates to accommodate installation of 16 inch widths of cavity wall insulation.
3. Place additional wall ties within 12 inches of openings at intervals not exceeding 36 inches.
4. Secure wall tie anchor plates through sheathing to CFMF studs.

J. Masonry Flashings: Refer to Section 07 65 26 – Membrane Flashing and Section 07 62 00 – Sheet Metal Work.
1. Provide concealed flashing in masonry work at or above shelf angles, lintels, ledges and other obstructions to the downward flow of water in the wall so as to divert such water to the exterior.
2. Prepare masonry surfaces smooth and free from projections which could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with mastic before covering with mortar.
3. Extend metal flashings horizontally through exterior face of masonry and turn down 1/4 inch to form drip. Membrane flashings shall not extend beyond the face of the masonry.
4. Turn flashing up minimum 16 inches and seal to backup wall with termination bar. Cover termination bar and all anchors with liquid membrane.
5. Lap end joints minimum 6 inches and seal watertight.
6. Extend full length of lintels and shelf angles and minimum of 8-inches into masonry beyond openings on each end; turn up ends not less than 2" to form end dams.
7. Turn flashing, fold, and seal at corners, bends, and interruptions.

K. Lintels:
1. Install galvanized loose steel lintels over openings more than 12 inches wide in brick walls.
2. Install reinforced unit masonry lintels over openings more than 24 inches wide in CMU walls.
   a. Reinforce lintels as indicated on Drawings; coordinate with Structural drawings.
   b. Do not splice reinforcing bars.
   c. Support and secure reinforcing bars from displacement.
   d. Place and consolidate grout fill without displacing reinforcing.
   e. Allow masonry lintels to attain specified strength before removing temporary supports.
3. Maintain minimum 8 inch bearing on each side of opening.

L. Grouted Components:
1. Reinforce bond beams and pilasters as indicated on Drawings; coordinate with Structural drawings.
2. Splice reinforcement in accordance with Section 03 21 00.
3. Support and secure reinforcing bars from displacement.
4. Place and consolidate grout fill without displacing reinforcing.
5. At bearing locations, fill masonry cores with grout for minimum 12 inches both sides of opening.
6. Fill cores in hollow concrete masonry units with grout 24 inches under bearing plates, beams, lintels, posts, and similar items, unless otherwise indicated.

M. Reinforced Masonry:
1. Lay masonry units with core cells vertically aligned and cavities between wythes clear of mortar and unobstructed.
2. Place reinforcement bars as indicated on Drawings.
3. Splice reinforcement in accordance with Section 03 21 00.
4. Support and secure reinforcement from displacement.
5. Place and consolidate grout fill without displacing reinforcing.
6. Place grout in accordance with ACI 530.1 Specification for Masonry Structures.

N. Control and Expansion Joints:
1. Install control and expansion joints at the maximum spacing described above, and/or as otherwise indicated on Drawings
2. Do not continue horizontal joint reinforcement through control or expansion joints.
3. Form control joint with sheet building paper bond breaker fitted to one side of hollow contour end of block unit. Fill resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.
4. Form expansion joint by omitting mortar and cutting unit to form open joint.

O. Built-In Work:
1. As work progresses, install built-in door and window frames, wood nailing strips, anchor bolts, plates, and other items to be built-in the work and furnished by other sections.
2. Install built-in items plumb and level.
3. Bed anchors of metal door and window frames in adjacent mortar joints. Fill frame voids solid with grout or mortar. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
4. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath in the joint below and rod mortar or grout into core.
5. Do not build in materials subject to deterioration.

P. Cutting and Fitting:
1. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items penetrating masonry. Coordinate with other sections of work to provide correct size, shape, and location. At any cut openings in masonry walls, refer to Structural Drawings for lintel requirements.
2. Obtain Architect/Engineer's approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.
3. At all louver and/or window sill conditions, grind down outside edge of brick as required to provide positive drainage of subsill. Provide a minimum of 1/4-inch drop from face of window framing system and or louver frame, to the outside face of the brick veneer.

3.07 ERECTION TOLERANCES
A. Maximum Variation From Alignment of Columns and Pilasters: 1/4 inch.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft; 1/4 inch in 10 ft; 1/2 inch in 30 ft.

F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft with a maximum joint thickness of 1/2 inch.

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

H. Maximum Variation for Steel Reinforcement:
1. Install reinforcement within the tolerances specified in ACI 530.1 for foundation walls.
2. Plus or minus 1/2" inch when distance from centerline of steel to opposite face of masonry is 8 inches or less.
3. Plus or minus 1 inch when distance is between 8 and 24 inches.
4. Plus or minus 1-1/4 inch when distance is greater than 24 inches.
5. Plus or minus 2 inches from location along face of wall.

3.08 POINTING AND CLEANING

A. Wipe masonry with rough cloth as work progresses to remove loose mortar and prevent stains.

B. Upon completion of work, all holes shall be filled (except weep holes) with fresh mortar and tooled. Cut out defective joints and repoint.

C. After pointing has set and hardened, all exposed surface masonry shall be thoroughly cleaned with stiff fiber brushes and clear water. Do not use acid. Other products such as Prosoco or Sure-Klean may be used if approved, in writing, prior to start of masonry work by masonry manufacturer, mortar material manufacturers, and mason that product used will not affect, harm in any way, cause streaks, discoloration, deterioration of brick / mortar, etc.

D. All exposed masonry shall be left clean and free from mortar daubs and other stains and with watertight joints throughout.

E. At conclusion of work of this Section and as directed by the General Contractor, remove scaffolding and equipment used, clean up debris, refuse, and surplus materials and remove them from project site.

F. Comply with each manufacturer's written instructions for protecting building and other surfaces against damage from exposure to its products. Prevent paint removers and chemical cleaning solutions from coming into contact with people, motor vehicles, landscaping, buildings, and other surfaces that could be harmed by such contact.

1. Cover adjacent surfaces with materials that are proven to resist paint removers and chemical cleaners used unless products being used will not damage adjacent surfaces. Use protective materials that are waterproof and UV resistant. Apply masking agents according to manufacturer's written instructions. Do not apply liquid strippable masking agent to painted or porous surfaces. When no longer needed, promptly remove masking to prevent adhesive staining.

2. Do not apply chemical solutions during winds of enough force to spread them to unprotected surfaces.

3. Neutralize alkaline and acid wastes before disposal.

4. Dispose of runoff from operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.

G. Repair any cracks that appear in masonry by removal of full masonry unit back to next mortar joint.

H. Provide adequate temporary lighting to allow for proper installation of all masonry work.

3.09 FIELD QUALITY CONTROL

A. Field testing will be performed under the provisions of Section 01 45 29.

B. Testing of Mortar: In accordance with ASTM C780 for consistency, mortar aggregate ratio, water content, air content, and compressive strength.

C. Testing of Grout: In accordance with ASTM C1019.

3.10 INSPECTION

A. The architect may from time to time require the mason to remove several masonry units to review quality of joints.

1. If mortar joints do not meet the specifications, additional units shall be removed until satisfactory joints or beds are encountered, plus at least three (3) additional units for verification
2. Removal and replacement of units shall be done within the scope of work of this section without additional cost.

3.11 DEFECTIVE CONSTRUCTION

A. Correct defects appearing in the finished work for a period of two years after the date of Substantial Completion.

B. Defects shall include, but not be limited to, cracking, separating or color leaching of mortar, cracking, discoloration, or deterioration of masonry units, efflorescence in masonry units or joints, and water penetration through face brick or joints under normal exposure.

3.12 PROTECTION OF FINISHED WORK

A. Protect exposed external corners subject to damage. Protect base of walls from mud and mortar splatter.

B. Protect masonry and other items built into masonry walls from mortar droppings and staining caused by mortar.

C. Protect tops of masonry work with waterproof coverings secured in place without damaging masonry. Provide waterproof coverings where in-progress masonry work is exposed to weather.

END OF SECTION 04 20 00

SECTION 05 12 00 STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Structural steel framing members, support members.

B. Structural steel support members.

C. Base plates, shear stud connectors.

D. Grouting under base plates.

1.2 RELATED REQUIREMENTS

A. Section 05 21 00 - Steel Joist Framing.

B. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.

C. Section 07 81 00 - Applied Fire Protection: Fireproof protection to framing and metal deck systems.

1.3 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2023, with Errata (2024).

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2022.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

G. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

J. ASTM A514/A514M - Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding; 2022.

K. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

L. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2022.

M. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2023.

O. ASTM C827/C827M - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures; 2023.

P. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

Q. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).

R. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

S. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.

T. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

U. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

V. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2020.

W. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

X. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

Y. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

Z. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

AA. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

BB. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

CC. SSPC-SP 3 - Power Tool Cleaning; 2018.

DD. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.

2. Connections.

3. Indicate cambers and loads.

4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

E. Fabricator's Qualification Statement.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Structural steel members designated as architecturally-exposed structural steel (AESS) to also comply with Section 05 12 13.

C. Maintain one copy of each document on site.

D. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.

E. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

F. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.

G. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Comply with UL (FRD) Assembly Design No. as indicated on drawings.

2.2 MATERIALS

A. Steel Angles and Plates: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

E. Hot-Formed Structural Tubing: ASTM A501/A501M, seamless or welded.

F. Steel Plate: ASTM A514/A514M.

G. Steel Sheet: ASTM A1011/A1011M, Designation SS, Grade 30 hot-rolled, or ASTM A1008/A1008M, Designation SS, Grade 30 cold-rolled.

H. Pipe: ASTM A53/A53M, Grade B, Finish black.

I. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

J. Structural Bolts and Nuts: Carbon steel, ASTM A307, Grade Aand galvanized in compliance with ASTM A153/A153M Class C.

K. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

L. Unheaded Anchor Rods: ASTM F1554, Grade 36, plain, with matching ASTM A563/A563M nuts and ASTM F436/F436M Type 1 washers.

M. Headed Anchor Rods: ASTM F1554 Grade 36, plain.

N. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

O. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.

2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

3. Height Change, Plastic State; when tested according to ASTM C827/C827M:

a. Maximum: Plus 4 percent.

b. Minimum: Plus 1 percent.

P. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

D. Develop required camber for members.

2.4 FINISH

A. Prepare structural component surfaces in accordance with SSPC-SP 3.

B. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

2.5 SOURCE QUALITY CONTROL

A. Provide shop testing and analysis of structural steel.

1. Percentage Tested: 10 percent.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts," testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that conditions are appropriate for erection of structural steel and that the work may properly proceed.

3.2 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Allow for erection loads and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

C. Field weld components and shear studs indicated on shop drawings.

D. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

E. Do not field cut or alter structural members without approval of Architect.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

G. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 12 00

SECTION 05 21 00 STEEL JOIST FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Open web steel joists and shear stud connectors, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for floor and roof openings greater than 18 inches.

1.2 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel: Grouting base plates and bearing plates. Superstructure framing.

B. Section 05 12 00 - Structural Steel: Superstructure framing.

C. Section 05 31 00 - Steel Decking: Bearing plates and angles.

D. Section 05 31 00 - Steel Decking: Support framing for openings less than 18 inches in decking.

E. Section 05 50 00 - Metal Fabrications: Non-framing steel fabrications attached to joists.

F. Section 07 81 00 - Applied Fire Protection: Fireproof protection of joist framing and metal deck systems.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

C. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.

D. ASTM E94/E94M - Standard Guide for Radiographic Examination Using Industrial Radiographic Film; 2017.

E. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2019.

F. ASTM E165/E165M - Standard Practice for Liquid Penetrant Testing for General Industry; 2023.

G. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2021.

H. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2019.

I. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2023.

J. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2021, with Errata (2023).

K. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

L. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

M. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2020.

N. SJI 100 - Standard Specifications for K-Series, LH-Series, and DLH-Series Open Web Steel Joists, and for Joist Girders; 2020.

O. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; 2008.

P. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

Q. SSPC-SP 2 - Hand Tool Cleaning; 2018.

R. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, locations of joists, joist leg extensions, bridging, connections, and attachments.

C. Welders' Qualification Statement: Welders' certificates in accordance with AWS B2.1/B2.1M and dated no more than 12 months before start of scheduled welding work.

D. Manufacturer's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Design connections not detailed on drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI 100 Standard Specifications Load Tables and SJI Technical Digest No. 9.

1. Maintain one copy of each document on site.

C. Design and Installation Requirements: Comply with UL (FRD) Assembly Design No. as indicated on drawings.

D. Manufacturer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

E. Welder Qualifications: Welding processes and welding operators qualified in accordance with AWS D1.1/D1.1M and dated no more than 12 months before start of scheduled welding work.

F. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

G. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Joists:

1. Canam Group Inc: www.canam-steeljoists.ws
2. New Millennium Building Systems: www.newmill.com
3. Nucor-Vulcraft Group: www.vulcraft.com.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 MATERIALS

A. Open Web Joists: SJI Type K Joists:

1. Provide bottom and top chord extensions as indicated.
2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.
3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.
4. Finish: Shop primed.

B. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563/A563M nuts and ASTM F436/F436M washers.

C. Shear Stud Connectors: Made from ASTM A108 Grade 1015 bars.

D. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A 36/A 36M.

E. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

F. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

A. Drill holes in chords for attachment of wood nailers where indicated.

B. Frame special sized openings in joist web framing as detailed.

C. Space stud shear connectors on top of top chords at 6 inches on center.

2.4 FINISH

A. Shop prime joists as specified.

1. Do not prime surfaces that will be fireproofed, field welded, or in contact with concrete.

2. Leave other steel members unprimed.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

2.5 SOURCE QUALITY CONTROL

A. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

B. Welded Connections: Visually inspect all shop-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment.

C. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

D. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces.

E. Position and field weld joist chord extensions and wall attachments as detailed.

F. Install supplementary framing for floor and roof openings greater than 18 inches.

G. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

H. Do not field cut or alter structural members without approval of joist manufacturer.

I. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed , except surfaces specified not to be primed.

3.3 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch.

B. Maximum Offset From True Alignment: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts", testing at least 10 percent of bolts at each connection.

C. Welded Connections: Visually inspect all field-welded connections and test at least 10 percent of welds using one of the following:

1. Radiographic testing performed in accordance with ASTM E94/E94M.

2. Ultrasonic testing performed in accordance with ASTM E164.

3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.

4. Magnetic particle inspection performed in accordance with ASTM E709.

END OF SECTION 05 21 00

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SECTION 05 31 00 STEEL DECKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof deck.

B. Composite floor deck.

C. Metal form deck.

D. Supplementary framing for openings up to and including 18 inches.

E. Bearing plates and angles.

F. Stud shear connectors.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing.

B. Section 03 30 00 - Cast-in-Place Concrete: Concrete topping over metal deck.

C. Section 05 12 00 - Structural Steel: Support framing for openings larger than 18 inches and shear stud connectors.

D. Section 05 12 00 - Structural Steel: Placement of embedded steel anchors for bearing plates in cast-in-place concrete.

E. Section 05 21 00 - Steel Joist Framing: Support framing for openings larger than 18 inches and shear stud connectors.

F. Section 05 21 00 - Steel Joist Framing: Placement of embedded steel anchors for bearing plates and joist seats in cast-in-place concrete.

G. Section 05 50 00 - Metal Fabrications: Steel angle concrete stops at deck edges.

H. Section 07 81 00 - Applied Fire Protection: Spray applied fireproofing.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished; 2018.

C. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2020.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

E. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2023, with Editorial Revision.

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2023.

G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2023).

H. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2018, with Errata (2022).

I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

J. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; 2022.

K. ICC-ES AC70 - Acceptance Criteria for Power-Actuated Fasteners Driven into Concrete, Steel and Masonry Elements; 2019, with Editorial Revision (2021).

L. SDI (DM) - Publication No.30, Design Manual for Composite Decks, Form Decks, and Roof Decks; 2007.

M. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

N. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

O. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings; 1997 (Ed. 2004).

P. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

C. Shop Drawings: Indicate deck plan, support locations, projections, openings, reinforcement, pertinent details, and accessories.

D. Certificates: Certify that products furnished meet or exceed specified requirements.

E. Submit manufacturer's installation instructions.

F. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Design deck layout, spans, fastening, and joints under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.

C. Installer Qualifications: Company specializing in performing the work of this Section with minimum 3 years of experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Cut plastic wrap to encourage ventilation.

B. Separate sheets and store deck on dry wood sleepers; slope for positive drainage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Steel Deck:

1. Canam Steel Corporation: www.canam-steeljoists.ws.
2. Cordeck, Inc: www.cordeck.com.
3. New Millennium Building Systems: www.newmill.com
4. Nucor-Vulcraft Group: www.vulcraft.com.
5. Wheeling Corrugating Co: www.wheelingcorrugating.com.
6. Substitutions: See Section 01 60 00 - Product Requirements.

2.2 STEEL DECK

A. All Deck Types: Select and design metal deck in accordance with SDI Design Manual.

1. Calculate to structural working stress design and structural properties specified.
2. Maximum Vertical Deflection of Floor Deck: 1/360 of span.
3. Maximum Vertical Deflection of Roof Deck: 1/240 of span.
4. Maximum Vertical Deflection of Form Deck: 1/360 of span.
5. Maximum Lateral Deflection of Diaphragms: 1/500 of the height of the wall.

B. Acoustical Roof Deck: Non-composite type, steel sheet with plain vertical flute faces perforated with 1/8 inch diameter holes staggered 3/8 inch on center:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

2. Primer: Shop coat of manufacturer's standard primer paint over cleaned and phosphatized substrate.

3. Structural Properties:

   a. Span Design: Double.

4. Minimum Base Metal Thickness: 22 gauge, 0.0299 inch.

5. Nominal Height: 1-1/2 inch.

6. Profile: Fluted; SDI NR.

7. Formed Sheet Width: 24 inch.

8. Side Joints: Lapped, mechanically fastened.

9. End Joints: Lapped, mechanically fastened.

10. Fire Resistance Classification: Comply with UL (FRD) Assembly Number as indicated on drawings.

C. Roof Deck: Non-composite type, fluted steel sheet:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

2. Span Design: Double.

3. Minimum Base Metal Thickness: 22 gauge, 0.0299 inch.

4. Nominal Height: 1-1/2 inch.

5. Profile: Fluted; SDI NR.

6. Formed Sheet Width: 24 inch.

7. Side Joints: Lapped, mechanically fastened.

8. End Joints: Lapped, mechanically fastened.

9. Fire Resistance Classification: Comply with UL (FRD) Assembly Number as indicated on drawings.

D. Composite Floor Deck: Fluted steel sheet embossed to interlock with concrete:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.

2. Span Design: Double.

3. Minimum Base Metal Thickness: 22 gauge, 0.0299 inch.
4. Nominal Height: 1-1/2 inches.
5. Profile: Fluted; SDI NR.
6. Formed Sheet Width: 24 inch.
7. Side Joints: Lapped, mechanically fastened.
8. End Joints: Lapped, mechanically fastened.
9. Fire Resistance Classification: Comply with UL (FRD) Assembly Number ____.

E. Metal Form Deck: Corrugated sheet steel, with provision for ventilation of concrete:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
2. Formed Sheet Width: 24 inch.
3. Side Joints: Lapped, welded.
4. End Joints: Lapped, welded.

2.3 ACCESSORY MATERIALS

A. Bearing Plates and Angles: ASTM A36/A36M steel unfinished.

B. Stud Shear Connectors: Made from ASTM A108 Grade 1015 bars.

C. Welding Materials: AWS D1.1/D1.1M.

D. Fasteners: Galvanized hardened steel, self tapping.

E. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

1. Design Requirements: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.
2. Material: Steel; ASTM A510/A510M.
    a. Hardness: Rockwell C 54.5, minimum.
    b. Tensile Strength: 285 kips per square inch, minimum.
    c. Shear Strength: 175 kips per square inch, minimum.
    d. Washers:

1) Steel Bar Joist Framing Applications: 0.472 inch diameter, minimum.

2) Exposed Roof Deck Applications: 0.591 inch diameter, minimum.

e. Corrosion Resistance:

1) Steel Bar Joist Framing Applications: ASTM B633, SC1, Type III zinc electroplate..

2) Exposed Roof Deck Applications: Provide manufacturer's standard stainless steel sealing caps with bonded neoprene washer over each fastener.

F. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

1. Design Requirements for Sidelap Connections: Provide number and type of fasteners that comply with the applicable requirements of SDI (DM) design method for roof deck and floor deck applications and ICC-ES AC43.

2. Fasteners for Steel Roof Decks Protected with Waterproofing Membrane: ASTM B633, SC1, Type III zinc electroplate.

3. Fasteners for Exposed Steel Roof Deck Application: Manufacturer's standard stainless steel with bonded neoprene washer.

4. Products:

a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

I. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, complying with VOC limitations of authorities having jurisdiction.

J. Flute Closures: Closed cell foam rubber, 1 inch thick; profiled to fit tight to the deck.

K. Acoustical Insulation: Glass fiber type, minimum 1.1 lb/cu ft density; profiled to suit deck.

2.4 FABRICATED DECK ACCESSORIES

A. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gauge, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

B. Roof Sump Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below roof deck surface, bearing flange 3 inches wide, sealed watertight.

C. Floor Drain Pans: Formed sheet steel, 14 gauge, 0.0747 inch minimum thickness, flat bottom, sloped sides, recessed 1-1/2 inches below floor deck surface, bearing flange 3 inches wide, sealed watertight.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. On concrete and masonry surfaces provide minimum 4 inch bearing.

C. On steel supports provide minimum 1-1/2 inch bearing.

D. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods specified.

1. Welding: Use fusion welds through weld washers.

2. Place and secure special deep fluted sections for integral concrete bridging.

E. At mechanically fastened male/female side laps fasten at 24 inches on center maximum.

F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

G. At welded male/female side laps weld at 18 inches on center maximum.

H. Weld deck in accordance with AWS D1.3/D1.3M.

I. At deck openings from 6 inches to 18 inches in size, provide 2 by 2 by 1/4 inch steel angle reinforcement. Place angles perpendicular to flutes; extend minimum two flutes beyond each side of opening and fusion weld to deck at each flute.

J. At deck openings greater than 18 inches in size, provide steel angle reinforcement. as specified in Section 05 12 00.

K. Where deck (other than cellular deck electrical raceway) changes direction, install 6 inch minimum wide sheet steel cover plates, of same thickness as deck. Fusion weld 12 inches on center maximum.

L. At floor edges, install concrete stops upturned to top surface of slab, to contain wet concrete. Provide stops of sufficient strength to remain stationary without distortion.

M. At openings between deck and walls, columns, and openings, provide sheet steel closures and angle flashings to close openings.

N. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

O. Place metal cant strips in position and fusion weld.

P. Position roof drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

Q. Position floor drain pans with flange bearing on top surface of deck. Fusion weld at each deck flute.

R. Weld stud shear connectors through steel deck to structural members below.

S. Immediately after welding deck and other metal components in position, coat welds, burned areas, and damaged surface coating, with touch-up primer.

END OF SECTION 05 31 00

SECTION 05 40 00 COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Exterior wall sheathing.

C. Water-resistive barrier over sheathing.

1.2 RELATED REQUIREMENTS

A. Section 04 26 13 - Masonry Veneer: Veneer masonry supported by wall stud metal framing.

B. Section 06 10 00 - Rough Carpentry: Wall sheathing.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Head and sill flashings.

D. Section 09 21 16 - Gypsum Board Assemblies: Cold-formed steel nonstructural framing.

E. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.3 DEFINITIONS

A. General: See AISI S240 for definitions of terms used in this section.

B. Connection: A combination of structural elements and joints used to transmit forces between two or more members.

C. Connector: A device used to transmit forces between cold-formed steel structural members or between a cold-formed steel structural member and another structural element.

1.4 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

E. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2020.

F. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

G. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2020.

H. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2017.

I. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2023a.

J. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

L. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to metal framing systems, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

B. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by affected installers.

1.6 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: Provide manufacturer's data on factory-made connectors and mechanical fasteners, showing compliance with requirements.

D. Product Data: For lateral-force resisting systems, provide product data sheets on hold-down, showing compliance with requirements.

E. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

1. Indicate stud and ceiling joist layout.

2. Describe method for securing studs to tracks and for bolted framing connections.

F. Manufacturer's Installation Instructions: For lateral-force resisting systems, indicate welding procedure specifications.

G. Installation Drawings: Indicate dimensioned locations of cold-formed steel structural framing.

H. SSFSA Manufacturer Qualification: Submit documentation of manufacturer association membership.

1.7 QUALITY ASSURANCE

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Designer Qualifications: Design framing system under direct supervision of a professional structural engineer experienced in designing this work and licensed in the State in which the Project is located.

C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum three years of documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience and approved by manufacturer.

1.8 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide mock-up of exterior framed wall, including components specified elsewhere, such as insulation, sheathing, window frame, door frame, exterior wall finish, and interior wall finish.

C. Mock-Up Size: 8 by 8 feet, including corner condition.

D. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Structural Framing:

1. CEMCO: www.cemcosteel.com.
2. ClarkDietrich Building Systems: www.clarkdietrich.com.
3. Jaimes Industries: www.jaimesind.com.
4. MarinoWARE: www.marinoware.com/#sle.
5. SCAFCO Corporation: www.scafco.com.
6. Steel Construction Systems: www.steelconsystems.com.
7. The Steel Network, Inc: www.SteelNetwork.com.
8. Substitutions: See Section 01 60 00 - Product Requirements.

B. Connectors:

1. Same manufacturer as metal framing.

2.2 PERFORMANCE REQUIREMENTS

A. Comply with requirements for Contractor's design-related professional design services indicated in Section 01 40 00 - Quality Requirements.

B. Design Requirements: Design cold-formed framing systems, components and connectors to withstand specified design loads in compliance with ICC (IBC), ASCE 7, AISI S100, and AISI S240.

C. Regulatory Requirements: Comply with applicable building code criteria for loads, including seismic loads.

1. Live load deflection meeting the following, unless otherwise indicated:

a. Exterior Walls: Maximum horizontal deflection under wind load of 1/600 of span.

b. Design nonaxial loadbearing framing to accommodate not less than 1/2 in vertical deflection.

2. Able to tolerate movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.

3. Able to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

4. Fabrication:

a. Shop-fabricate cold-formed framing systems and connectors to the greatest extent possible.

b. Deliver to project site in largest practical sections.

2.3 MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

2.4 STRUCTURAL FRAMING COMPONENTS

A. Wall Studs and Track Sections: AISI S240; c-shaped studs and u-shaped track sections in stud-matching nominal width and compatible height.

1. Thickness and Depth: As indicated on drawings.

2. Provide components fabricated from ASTM A1011/A1011M Designation SS (structural steel).

3. Products:

    a. MarinoWARE; StudRite: www.marinoware.com.

    b. MarinoWARE; Structural Framing: www.marinoware.com

    c. MBA Building Supplies; Structural Studs & Track: www.mbastuds.com/#sle.

    d. Super Stud Building Products, Inc; SuperMAXX Studs: www.buysuperstud.com

    e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Jamb Studs: AISI S240; manufactured, engineered, c-shaped with wide flanges, designed to replace conventional double-stud framing at openings.

1. Thickness and Depth: As indicated on drawings.

2. Products:

    a. SCAFCO Corporation; Kwik-Jamb Studs: www.scafco.com.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Headers: AISI S240; manufactured, engineered one-member or two-member assemblies, with wide flanges, designed to replace conventional box or nested header framing at openings.

1. Thickness and Depth: As indicated on drawings.

2. Jamb Mounting Clips: Manufacturer's standard.

3. Cripple Stud Clips: Manufacturer's standard.

4. Products:

    a. SCAFCO Corporation; HD Header: www.scafco.com.

    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Joists: AISI S240; manufactured, engineered open-web steel joists.

1. Thickness and Depth: As indicated on drawings.

2. Products:

    a. MarinoWARE; JoistRite: www.marinoware.com

    b. Super Stud Building Products, Inc; SuperMAXX Joists: www.buysuperstud.com.

    c. Substitutions: See Section 01 60 00 - Product Requirements.

2.5 LATERAL FORCE-RESISTING SYSTEMS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

1. Structural Grade: As required to meet design criteria.

2. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

B. Curtain Wall Studs and Girts:

1. Thickness and Depth: As indicated on drawings.

C. CONNECTIONS

1. Performance Requirements: Provide connections in compliance with requirements of AISI S240.

2. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S240.

a. Structural Grade: As required to meet design criteria.

b. Corrosion Protection Coating Designation: CP 60 in accordance with AISI S240.

3. Structural Performance: Maintain load and movement capacity required by applicable building code and specified design criteria.

4. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.

a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.

b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch.

c. Products:

1) ClarkDietrich; Drift FastClip Slide Clip D-FCSC: www.clarkdietrich.com.

2) ClarkDietrich; FastClip Slide Clip FCSC: www.clarkdietrich.com.

3) MarinoWARE; WSC Slide Clips: www.marinoware.com

4) MBA Building Supplies; Slotted Track: www.mbastuds.com

5) Simpson Strong Tie: www.strongtie.com.

6) Super Stud Building Products, Inc; Deflection Clips: www.buysuperstud.com.

7) Substitutions: See Section 01 60 00 - Product Requirements.

5. Fixed Connections: Provide nonmovement devices for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

a. Products:

1) Simpson Strong Tie: www.strongtie.com.

2) Substitutions: See Section 01 60 00 - Product Requirements.

6. Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connectors where indicated on the drawings.

7. Products:

a. ClarkDietrich; Spazzer 5400 Bridging Bar: www.clarkdietrich.com

b. ClarkDietrich; FastBridge Clip: www.clarkdietrich.com

c. Simpson Strong-Tie; SUBH Bridging Connector: www.strongtie.com

d. Substitutions: See Section 01 60 00 - Product Requirements.

2.6 MISCELLANEOUS CONNECTIONS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot-dip galvanized per ASTM A153/A153M.

1. Products:

a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: www.ITWBuildex.com.

b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Anchorage Devices: Powder actuated, Drilled expansion bolts, and Screws with sleeves.

2.7 SHEATHING

A. Glass-mat-faced gypsum board; ASTM C1177/C1177M, square long edges, 5/8 inch thick, Type X - fire-resistant.

B. Polyisocyanurate (ISO) foam board insulation; ASTM C1289, Type I - Faced with aluminum foil on both major surfaces of core foam, and Class 1 - Nonreinforced core foam; 3/4 inch thick.

2.8 ACCESSORIES

A. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.

B. Galvanizing Repair: Touch up bare steel with zinc-rich paint in compliance with ASTM A780/A780M.

C. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

E. Water-Resistive Barrier: ICC-ES AC38 Grade D and 60-minute plastic sheet.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

B. Verify field measurements and adjust installation as required.

3.2 PREPARATION

A. Structural Wall Foundations: For gaps between wall bottom track and top of foundation 1/4 inch or greater, level substrate with loadbearing shims or grout between track and foundation.

3.3 INSTALLATION - GENERAL

A. Install structural members and connections in compliance with ASTM C1007.

3.4 INSTALLATION OF STUDS

A. Install wall studs plumb and level except where designed as sloping members.

B. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

C. Install load-bearing studs full length in one piece. Splicing of studs is not permitted.

D. Install load-bearing studs; brace, and reinforce to develop full strength and achieve design requirements.

E. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

F. Install intermediate studs above and below openings to align with wall stud spacing.

G. Provide deflection allowance in stud track, directly below horizontal building framing at non-loadbearing framing.

H. Attach cross studs to studs for attachment of fixtures anchored to walls.

I. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.

J. Touch-up field welds and damaged corrosion protected surfaces with primer.

3.5 INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

C. Place joists at 12 inches on center; not more than 2 inches from abutting walls, and connect joists to supports using fastener method.

D. Set floor and ceiling joists parallel and level, with lateral bracing and bridging.

E. Locate joist end bearing directly over load-bearing studs or provide load distribution on top of stud track.

F. Provide web stiffeners at reaction points.

G. Touch-up field welds and damaged primed surfaces with primer.

3.6 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.

2. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges, and ends.

3.7 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide material verification inspections in accordance with requirements of AISI S240.

C. Provide inspections for mechanical fastening and cold-formed steel light-frame construction in accordance with requirements of AISI S240.

3.8 TOLERANCES

A. Studs - Vertical Alignment (Plumbness): 1/960 of span or 1/8 inch in 10 ft, in accordance with ASTM C1007.

B. Studs - Maximum Variation from True Position: 1/8 inch in accordance with ASTM C1007.

C. Stud Spacing: 1/8 inch from the designated spacing, provided that the cumulative error does not exceed the requirements of the finishing materials in accordance with ASTM C1007.

D. Maximum Variation from True Position: 1/8 inch.

E. Maximum Variation of any Member from Plane: 1/8 inch.

END OF SECTION 05 40 00

SECTION 05 50 00 METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Prefabricated ladders and ship ladders.

1.02 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

B. Section 05 51 00 - Metal Stairs.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

C. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

J. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2014.

K. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

L. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

M. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

N. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2014.

O. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings; 2014e1.

P. ASTM B85/85M - Standard Specification for Aluminum-Alloy Die Castings; 2014.

Q. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011.

R. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

S. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2012.

T. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire; 2012e1.

U. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

V. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

W. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

X. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; American Welding Society; 2008.

Y. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; Society for Protective Coatings; 1999 (Ed. 2004).

Z. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

AA. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

AB. LEED 2009 for Schools, New Construction and Major Renovations.

1.04 SUBMITTALS

A. See Section 01 30 00 - Contractor Requirements.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Minimum Recycled Content: 50% minimum post-consumer recycled content.

B. Steel Sections: ASTM A 36/A 36M.

C. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

D. Plates: ASTM A283.

E. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

F. Slotted Channel Framing: ASTM A653/A653M, Grade 33.

G. Slotted Channel Fittings: ASTM A1011/A1011M.

H. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

I. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

J. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.

D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.

E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.

F. Aluminum-Alloy Die Castings: ASTM B85/B85M.

G. Bolts, Nuts, and Washers: Stainless steel.

H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by intermittent welds and plastic filler.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Ladders: Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
   1. Side Rails: 3/8 x 2 1/2 inches (10 x 64 mm) members spaced at 20 inches (500 mm) unless detailed otherwise on the drawings.
   2. Rungs: 3/4 inch (19 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
   3. Space rungs 7 inches (175 mm) from wall surface.

B. Bollards: Steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

C. Joist Hangers: Strap anchors, fabricated with sheet steel, 18 gage, 0.0478 inch (1.21 mm) minimum base metal thickness; galvanized finish.

D. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

E. Lintels: As detailed; galvanized finish.

F. Sill Angles for Tempered Glass Railing Assemblies: ASTM A36/A36M steel angles with anchoring devices and sizes as indicated in shop drawings for railing assembly, drilled and tapped for fastener types, sizes, and spacing indicated, galvanized finish.

G. Door Frames for Overhead Door Openings and Wall Openings: Channel sections; prime paint finish.

H. Mud and Foot Grilles and Pans: As detailed; aluminum, mill finish.

I. Elevator Hoistway Divider Beams: Beam sections; prime paint finish.

J. Toilet Partition Suspension Members: Steel channel sections; prime paint finish.

K. Slotted Channel Framing: Fabricate channels and fittings from structural steel complying with the referenced standards; factory-applied, rust-inhibiting thermoset acrylic enamel finish.

2.05 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
   3. Products:
      a. O'Keeffe's Inc; Model 500: www.okeeffes.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
   2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.

2.06 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: One coat.

E. Galvanizing of Structural Steel Members where indicated on the drawings: Galvanize after fabrication to ASTM A 123/A 123M requirements.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.07 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized.

B. Interior Aluminum Surfaces: Class I natural anodized.

C. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

D. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

E. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

F. Class II Color Anodized Finish: AAMA 611 AA-M12C22A32 Integrally colored anodic coating not less than 0.4 mils (0.01 mm) thick; light bronze.

G. Class II Color Anodized Finish: AAMA 611 AA-M12C22A34 Electrolytically deposited colored anodic coating not less than 0.4 mils (0.01 mm) thick; light bronze.

H. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

2.08 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION 05 50 00

SECTION 05 52 13 PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes interior and exterior steel pipe railings. All interior railings shall be painted steel unless otherwise noted; all exterior railings shall be galvanized unless otherwise noted.

1.2 PERFORMANCE REQUIREMENTS

A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

1. Steel: 72 percent of minimum yield strength.

B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Handrails:

a. Uniform load of 50 lbs/ ft. applied in any direction.
b. Concentrated load of 200 Ib/ft applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Top Rails of Guards:

a. Uniform load of 50 Ibfl ft. applied in any direction.
b. Concentrated load of 200 Ibf applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

3. Infill of Guards:

a. Concentrated load of 50 Ib/ft applied horizontally on an area of 1 sq. ft ..

4. Thermal Movements: Provide exterior railings that allow for thermal movements.

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

1.6 COORDINATION AND SCHEDULING

A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.2 STEEL AND IRON

A. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
1. Steel pipe for handrails shall not exceed 1-1/2" O.D.

B. Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Castings: Either gray or malleable iron, unless otherwise indicated.
1. Gray Iron: ASTM A *48/A* 48M, Class 30, unless another class is indicated or required by structural loads.
2. Malleable Iron: ASTM A 47/A 47M.

2.3 FASTENERS

A. General: Provide the following:
1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated. All floor connections and wall connections (not including wall brackets) shall have escutcheon cover plates to conceal attachment fasteners/method.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.

2. Provide square or hex socket flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Anchors: Provide torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinccoated steel and for compatibility with finish paint systems indicated, and complying with SSPCPaint 5.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

H. Form changes in direction by bending or by inserting prefabricated elbow fittings.

I. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

J. Close exposed ends of railing members with prefabricated end fittings.

K. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings ..

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

C. All exterior railing systems shall be hot-dipped galvanized. All interior railings shall be painted steel.

2.7 STEEL AND IRON FINISHES

A. Galvanized Railings:
1. Hot-dip galvanize steel and iron railings, including hardware, after fabrication.
2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.

B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

D. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

E. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No.1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.

D. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

E. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

F. Adjust railings before anchoring to ensure matching alignment at abutting joints.

G. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.2 RAILING CONNECTIONS

A. Non-welded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.

C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

3.3 ANCHORING POSTS

A. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than O.D. of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1I8-inch buildup, sloped away from post.

3.4 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Use type of bracket with predrilled hole for exposed bolt anchorage.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:
1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3.5 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.6 PROTECTION

A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 52 13

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. All rough carpentry items including, but not limited to:
   1. Wood blocking for support of items supported on or recessed into wood framing or requiring wood blocking for support.
   2. Wood cants, nailers, curbs, and other items associated with roofing work.
   3. Miscellaneous framing items and plywood sheathing.

1.3 RELATED WORK

A. All Sections of Work supported on or recessed into wood framing or requiring wood blocking for support, such as wall trim, wall cabinets, handrails, lockers, toilet compartments, toilet and bath accessories, markerboards, tackboards, projection screens, fire extinguisher cabinets, etc., as applicable to the Project.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s data on wood treatment materials.

1.5 STANDARDS AND GRADING

A. All lumber used structurally shall be graded and marked with grade and trademark of a lumber grading organization approved by the Architect, except that a certification of grade from such a grading organization may be accepted in lieu of grade and trademarks when approved by Architect. Trademark of manufacturer shall also appear on each piece.

B. Each piece of plywood used structurally shall carry the American Plywood Association trademark.

C. Grading Rules: Conform with all applicable requirements of American Lumber Standards "Simplified Practice Recommendations R-16" and to grading rules of manufacturer's association under whose rules the lumber is produced.

D. Reference Standards: Conform with all requirements.
   1. U.S. Dept. of Commerce Product Standards (PS)
   2. American Plywood Association (APA)
      a. Standards and Construction Guide
   3. American Wood Preservers Association (AWPA)
      a. Standards, as they apply.
   4. Architectural Woodwork Institute (AWI)
      a. "Quality Standards"
   5. National Woodwork Manufacturers’ Association (NWMA)
      a. Standards
   6. Western Wood Products Association (WWPA)
      a. Manual

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:
1. Treated No. 2, S4S Southern Yellow Pine, #1 kiln dried.
   a. Comply with NWMA Standards
   b. Use for blocking, stripping, grounds, cants and miscellaneous wood items in contact with concrete, roofing, or exposed to the weather.
2. No. 2, S4S Southern Yellow Pine: Use for framing, blocking, stripping and miscellaneous concealed interior lumber not exposed to concrete, roofing weather or moisture, when FRS lumber is not required by building code.
3. Fire Retardant No, 2, S4S Southern Pine: Refer to Fire Retardant Treatment below. Use for framing, plates and blocking in all walls and partitions where required by building code or noted on drawings.

B. Plywood:
1. General: Comply with APA Standards.
2. APA A-D, Group 1 Interior used where appearance of only one side is exposed to view for interior locations. Use for wall liner at MDF/IDF closets and telephone boards in mechanical and telephone rooms where shown or required. 3/4 inch thick unless required or shown otherwise. Paint as scheduled in Section 09 91 00.
3. Exterior plywood, Group 1, APA rated sheathing. Use where miscellaneous plywood is exposed to concrete, weather, or at roof construction as sheathing.
4. Fire Retardant Treated Plywood: Refer to Fire Retardant Treatment below. Use when required by building code or noted on drawings.
5. Underlayment: If shown or required, APA rated Sturdi-floor, exterior grade, tongue and groove edges.

C. Rough Hardware:
1. Nails, Spikes, and Staples: Galvanized for exterior locations, high humidity locations, and treated wood; plain finish for other interior locations: Size and type to suit application. Do not use to resist “pull-out” loads.
2. Bolts, Nuts, Washers, Lags, and Screws: Medium carbon steel; size and type to suit application. Galvanize for exterior locations, high humidity locations, and treated wood. Plain finish for other interior locations.
3. Fasteners: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry and concrete. Bolts or power activated type for anchorage to steel.

D. Wood Treatment:
1. Preservative Treatment (Concealed Conditions):
   a. Micronized Copper Quaternary (MCQ): Pressure impregnate preservative to net retention of 0.25 lbs./cu.ft., in plant licensed by manufacturer in accordance with the following standards:
      1) Preservative Treatment Standard: AWPA P5
      2) Structural Lumber Treatment Standard: AWPA C31
      3) Plywood Treatment Standard: AWPA C9
   b. Brush two (2) coats of preservative on bored or sawn surfaces of treated lumber.
   c. Provide Quality Mark Stamp on treated wood for identification.
   d. Fasteners: Metal fasteners in contact with preservative treated wood shall be G-90 galvanized, minimum, or stainless steel in accordance with

manufacturer's instructions. No uncoated steel shall come in contact with preservative wood.

e. ACQ and CCA preservatives not permitted.

f. Acceptable Manufacturers: Osmose "MicroPro" Smart Sense; or Architect approved equal.

2. Fire Retardant Treatment:

a. Lumber shall be pressure-impregnated with non-combustible fire retardant chemicals in accordance with U.L. FRS Fire Hazard Classification. All lumber must be dried following treatment in accordance with AWPA Standard C20.

b. Plywood shall be pressure-impregnated with non-combustible fire retardant chemicals in accordance with U.L. FRS Fire Hazard Classification. All plywood must be dried following treatment in accordance with AWPA Standards C27.

PART 3 - EXECUTION

A. Wood Framing:

1. Framing and blocking shall be accurately cut and fitted true to line and levels, avoiding shims and wedges.
2. Spiking and nailing shall be done using largest size spikes and nail practicable.
3. Unless otherwise shown, use 2 inch by 4 inch wood studs spaced 16 inches o.c. with 4 inch face perpendicular to direction of wall or partition. Provide single bottom plate and double-top plates 2 inches thick by width of studs.
4. Bolt nailers and blocking to steel, masonry or concrete members with bolts or proportionate strength of members attached from each end, except as otherwise noted on plans.
5. Provide blocking, bucks and framing as necessary and for other trades as required.
6. Drill lumber accurately for bolts and fit all bolts with suitable washers.
7. Perimeter wood blocking to be attached 2'-0" staggered with 1/2" galvanized bolts through both nailers.
8. Screws are to be used for perimeter edge nailers. No nailing permitted.

B. Plywood:

1. Install plywood over framing in accordance with instruction of American Plywood Association Construction Guide Form No. E30C.
2. Install underlayment plywood as shown in accordance with instructions of American Plywood Association. Space panel joints and edges 1/32 inch. Fill and sand panel edge joints, surface roughness, and damaged or open areas. Nail with 4d ring-shank nails spaced at six (6) inches at edges and eight (8) inches in field each way.

END OF SECTION

SECTION 06 20 00 MILLWORK & FINISH CARPENTRY

PART 1 - GENERAL REQUIREMENTS

1.01 SCOPE

A. This section includes:

1. Miscellaneous architectural finish woodwork and trim
2. Wood shelving and moldings
3. Transparent finishing.
4. Medium Density Fiberboard (MDF) for plastic laminate finish
5. Plastic Laminate

B. This section DOES NOT include cabinets and/or casework. Refer to Division 12 for wood cabinets or plastic laminated cabinets or prefabricated cabinets or furniture.

RELATED WORK

A. Division 6 Section Rough Carpentry for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.

B. Division 8 Section Wood Doors.

C. Division 12 Section for shop-built casework units.

1.02 GENERAL REQUIREMENTS

A. Woodwork Details: Shall be done in accordance with details shown on drawings. For details not shown, architect will furnish scale details on request or standard details or Architectural Woodwork Institute “Custom Grade” shall govern.

B. Moisture Content: All millwork shall be kiln dried to average not more than 7% to 10%.

C. Workmanship: Shall be of the best customarily done on work of this type. The intent is that joints be neatly and carefully made, surfaces straight and clean, work sanded with the grain, all machine marks removed by sanding except on exterior material which shall be cleanly machined. All cross surfaces shall be eliminated. Shop assembled surfaces shall be glued where possible on non-exposed surfaces to receive stain finish. All connections shall be made by best-approved practice of the cabinet making trade, including dadoes for shelves, mortises and tenon where possible. Wood frame shall be mitered jamb to head.

D. Prefabricated cabinets (casework) are not included in this section; see specification sections 12320.

1.03 QUALITY ASSURANCE

A. Standards: The latest edition of the “Quality Standards” and “Architectural Casework Details” of the Architectural Woodwork Institute shall apply and by reference are hereby made a part of this specification. Any reference to Premium, Custom, or Economy in the specification shall be as defined in the latest edition of the AWI “Quality Standards.” Any item not given a

specific quality grade shall be custom grade as defined in the latest edition of the AWI "Quality Standards."

B. Competence: The approved woodwork manufacturer must have a reputation for doing satisfactory work on time and shall have successfully completed comparable work.

1.04 SUBMITTALS

A. Submit MSDS for each composite wood or agrifiber product with urea – formaldehyde resin limits highlighted.

B. Shop drawings showing complete construction details, kinds of material, size of members and methods of securing members together and to adjacent work shall be submitted to the architect before proceeding with the work.

C. Samples of lumber and panel products with or for transparent finish, for each species and cut, finished on one side and one edge.

1.05 ENVIRONMENTAL LIMITATIONS

A. Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

1.06 INSPECTION AND STORAGE

A. As soon as space can be made available where millwork can be stored in a protected area, contractor shall inform millwork subcontractor that he is ready to receive millwork.

B. Upon delivery, contractor shall inspect all millwork for scratches, marks, or other damage and shall reject that which cannot be satisfactorily repaired by millwork subcontractor.

C. Upon delivery, contractor shall arrange for all millwork to receive first coat of finish. Contractor shall also take care that all hardware has been carefully and properly installed.

PART 2 - PRODUCTS

2.01 WOOD MATERIALS

A. All composite wood or agrifiber products must contain no added urea-formaldehyde resins.
1. Refer to drawings for locations where products will be installed.

B. Material Grades: AWI Premium grade unless otherwise noted. Lumber and plywood shall be kiln-dried to equilibrium moisture content suitable for fabrication in shop and suitable for use intended.

C. Lumber (Solid Stock): Red Oak, plain sawn.
Semi-Exposed Portions: Red Oak, plain sawn.
Concealed Portions: Douglas Fir.

D. Plywood: Red Oak veneer, plain sawn; Book-matched.
Semi-Exposed Portions: Red Oak veneer, plain sawn; Book-matched.
Concealed Portions: Douglas Fir with minimum ¼" edge banding matching exposed solid stock.
1. Red Oak: A-A Int. APA where both sides exposed; A-D Int. APA where one side exposed.

2. Douglas Fir: "Utility shelving" for storage rooms shall be STAIN GRADE Douglas fir for clear transparent finish. A-A Int. APA where both sides exposed; A-D Int. APA where one side exposed.

E. Medium Density Fiberboard (MDF): Shall be nominal ¾" to 1" thick engineered wood sheet comprised of high temperature and pressure condensed wood fibers with wax and resin binders with density between 31 lbs/ft^3 and 62 lbs/ft^3.

1. Provide two (2) coats of recommended sealer before application of laminate finish.
2. Respirator must be worn when cutting of MDF materials.

F. Plastic laminate

1. Laminated Plastic – General Use: Laminated plastic shall be high-pressure type conforming to NEMA standards #LD3-2005.. Plastic sheets shall be laminated to MDF, under pressure, with adhesive recommended by the manufacturer.

2. Approved laminate manufacturers:

a. Wilsonart International
b. Nevamar Decorative Surfaces (Panolam Industries)
c. Formica Corporation
d. Abet Laminati
e. Pionite
f. Arborite

3. Exposed Vertical surfaces (trim, aprons, etc.-General Purpose) .028"+/- .004)
Tops (square edges – General Purpose) .048" (+/- .005)
Tops (post formed) .039" (+/- .005)

2.02 HARDWARE

A. Typical Unfinished Bolts, Lag Bolts (Lag Screws), Nuts and Washers: Low carbon steel standard fasteners, externally and internally threaded, ASTM A307; malleable washers.

B. Nails, Typical Interior: Common wire galvanized, typical.

C. Exposed Nails and Fastenings for Exterior Use: Hot dip galvanized or stainless steel.

D. Screws: Self-drilling and self-tapping type, size as noted. Same as Buildex's "TEKS Fasteners"; The Rawlplug Co., Inc's "Rawl Self-Drilling Screws"; or approved equal.

E. Screws, Trim Head: Self-drilling, self-tapping screws with trim head for attaching wood trim to steel framing. Mfgr: US Gypsum Co.'s "USG Trim Head Screws, Wood Trim to Interior Steel Framing Type"; Buildex's "Hi-Lo Drywall Screw, Trim Head".

2.03 ROD AND SHELF BRACKETS (AS REQUIRED)

A. Fixed Rod and Shelf Bracket for 14" to 18" shelf shall be equal to KV 1199 Extra Duty Series bracket rated for up to 500 lbs per pair. Install shelf brackets at maximum 30" centers and install rod and shelf at max 48" above fin. floor to conform to ADA reach range.

2.04 ADJUSTABLE WALL SHELVES

A. Typical Adjustable Shelves: (Surface mounted)

1. Standards: Extra Heavy Duty type: Manufacturer Knape and Vogt Manufacturing Co.'s No. 87 anochrome finish. Installed 16" o.c. maximum

2. Brackets: Extra Heavy Duty type: Manufacturer Knape and Vogt Manufacturing Co.'s No. 187LL anochrome, length shall be 2" less than shelf depth.

3. Shelf Rests: Provide two (2) center rests (Manufacturer K&V's No. 211 ANO) with rubber cushion (Manufacturer K&V No. 129) at each bracket; one (1) at front and one (1) at back. Bolt rest to bracket and screw shelf to rest.

B. Typical Pilaster (recessed) shelving hardware

1. Standards: Manufacturer Knape and Vogt Manufacturing Co.'s No. 255; Grant Hardware Co.'s No. 120.

2. Supports: Manufacturer Knape and Vogt Manufacturing Co.'s No. 256; Grant Hardware Co.'s No. 21.

3. Shelf Supports: Knape & Vogt #256 Pilaster supports (4 per shelf)

PART 3- EXECUTION

3.01 FABRICATION

A. Preparation

1. Verify dimensions of receiving spaces at job site.
2. Verify details and dimensions of equipment and fixtures integral with architectural woodwork for proper fit and accurate alignment.
3. Coordinate details with other work supporting, adjoining, or fastening to architectural woodwork.

B. General: Complete fabrication, including assembly, and hardware application, to maximum ex-tent possible, before shipment to Project site. Where necessary for fitting at site, provide ample allowance for scribing, trimming and fitting.

C. Interior Woodwork Grade: Premium complying with the referenced quality standard.

D. Shop cut openings to maximum extent possible. Provide cut-outs as required for electrical installation. Sand edges of cut-outs to remove splinters and burrs.

E. Seal edges of openings in finish work with coat of varnish.

F. For trim items wider than available lumber, use veneered construction. Do not glue for width.

G. Conceal nailing where possible and set nail heads with putty on exposed portions.

H. Thoroughly hand-sand wood surfaces. Take care that cross sanding is removed by final sanding in direction of grain; ease “knife-edge” corners by sanding. Wood surface shall be free from dust, glue, stains, and other foreign matter and in proper condition to receive finish.

3.01 WORKMANSHIP/INSTALLATION

A. Fastening Schedule - Comply with requirements of IBC Table 2304.9.1 “Fastening Schedule” for all rough carpentry wood connections.

B. Fastening of Exposed Members: No exposed nails shall be used. All exposed members are to be glued using either pressure or electrical wood welder. All traces of excess glue shall be removed.

C. Install woodwork level, plumb, true and straight to a tolerance of 1/8 inch in 96 inches (3mm in 240mm). Shim as required with concealed shims.

D. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

E. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

F. Standing and Running Trim: Install with a minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base, if finished.

3.02 CLEANING AND PROTECTION

A. Protect all millwork and finish carpentry from damage by other trades.

B. Contractor shall repair or replace, to the satisfaction of the owner, all millwork and finish carpentry which has been damaged or that is improperly installed in any way.

C. Immediately prior to final inspection, clean all millwork and finish carpentry, remove dust, etc.

END OF SECTION 06 20 00

SECTION 06 61 16 SOLID SURFACING FABRICATIONS

PART 1 - GENERAL REQUIREMENTS

1.01 SCOPE

A. Furnish, erect, and perform all work at site and appurtenant work as shown and specified. Install countertops, serving lines and wall caps at locations shown on drawings.

1.02 DEFINITION

A. Solid surface is defined as nonporous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment.

1.03 SUBMITTALS

A. Shop drawings:

1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.

a. Show full-size details, edge details, thermoforming requirements, attachments, etc.

b. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement specified in other Sections.

c. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in solid surface.

C. Samples:

1. For each type of product indicated.

a. Submit minimum 6-inch by 6-inch sample in specified gloss.
b. Cut sample and seam together for representation of inconspicuous seam.
c. Indicate full range of color and pattern variation.

2. Approved samples will be retained as a standard for work.

D. Product data:

1. Indicate product description, fabrication information and compliance with specified performance requirements.

E. NSF/ANSI standards:

1. Refer to www.nsf.org for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.

F. Maintenance data:

1. Submit manufacturer’s care and maintenance data, including repair and cleaning instructions.
a. Maintenance kit for finishes shall be submitted.

2. Include in project closeout documents.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation.

B. Store components indoors prior to installation.

C. Handle materials to prevent damage to finished surfaces.
1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

1.05 WARRANTY

A. Provide manufacturer's warranty against defects in materials.
1. Warranty shall provide material and labor to repair or replace defective materials.

2. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

B. Manufacturer's warranty period:
1. Ten years from date of substantial completion.

1.06 MAINTENANCE
A. Provide maintenance requirements as specified by the manufacturer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Corian surfaces from DuPont Co
B. Formica Solid Surfacing
C. Wilsonart (Basis of Design)

2.01 MATERIALS
A. Solid polymer components
1. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.

2. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.

B. Thickness: ½" horizontal; ¼" vertical

C. Edge Treatment: Eased & Radiused (per Drawings)

D. Inlays:

1. Fabricate using manufacturer's approved method.
2. Rout 1/8" deep max. groove for inlay to pattern indicated on designer's drawings.
3. Fill groove using methods approved by manufacturer, avoiding air bubbles or voids.
4. Overfill inlay area.
5. Allow area to fully cure. Do not overheat inlay while sanding.
6. Finish and touch up to uniform appearance.

E. Finish: Provide surface with a uniform finish. Matte – Gloss range 5-20

2.02 ACCESSORIES

A. Joint adhesive:

1. Manufacturer's standard one- or two-part adhesive kit to create inconspicuous, nonporous joints.

B. Sealant:

1. Manufacturer's standard mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.

C. Sink/lavatory mounting hardware:

1. Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.

D. Conductive tape:

1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

E. Insulating felt tape:

1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

PART 3 - EXECUTION

3.01 FACTORY FABRICATION

A. Shop assembly

1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.

2. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
   a. Reinforce with strip of solid polymer material, 2" wide.

3. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.

4. Rout and finish component edges with clean, sharp returns.
   a. Rout cutouts, radii and contours to template.
   b. Smooth edges.
   c. Repair or reject defective and inaccurate work.

3.02 DELIVERY, STORAGE AND HANDLING

A. Deliver no products to site until ready for installation. Handle materials to prevent damage to finish surfaces. Provide protective covering to prevent staining or other damage.

B. Standards/Installation: Form field joints using manufacturer's recommended adhesive. Provide backsplashes and side splashes as indicated and adhere to tops using manufacturer's standard color matched silicone sealant. Make plumbing connections to sinks in accordance with Division 15. Protect surfaces from damage until date of Substantial Completion.

C. Workmanship: Workmanship shall be of best quality, accurate cuts, square bearing, close fitting, plumb and level, to lines and level indicated, secured rigidly in place. All material shall be installed in a workmanlike manner, free from scratches, blemishes, stains, and other disfigurations.

3.03 EXAMINATION

A. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 INSTALLATION

A. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

1. Provide product in the largest pieces available.

2. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
   a. Exposed joints/seams shall not be allowed.

3. Reinforce field joints with solid surface strips extending a minimum of 1 inch on either side of the seam with the strip being the same thickness as the top.

4. Cut and finish component edges with clean, sharp returns.

5. Rout radii and contours to template.

6. Anchor securely to base cabinets or other supports.

7. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.

8. Carefully dress joints smooth, remove surface scratches and clean entire surface.

9. Install countertops with no more than 1/8-inch (3 mm) sag, bow or other variation from a straight line.

B. Applied Backsplashes and Sidesplashes:

1. Install and adhere applied back/sidesplashes using manufacturer's standard color-matched silicone sealant.

C. Coved backsplashes and sidesplashes – to be coved at all countertops installed in wet locations (restrooms, locker rooms, etc.) and at all countertops that contain plumbing fixtures (sinks, etc.):

1. Provide coved backsplashes and sidesplashes at all walls and adjacent millwork.

2. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on the drawings.

3. Adhere to countertops using manufacturer's standard color-matched Joint Adhesive.

3.05 REPAIR

A. Repair or replace damaged work which cannot be repaired to architect's satisfaction.

3.06 CLEANING AND PROTECTION

A. Keep components clean during installation.

B. Remove adhesives, sealants and other stains.

END OF SECTION 06 61 16

SECTION 07 11 13 BITUMINOUS DAMPPROOFING

PART 1 - GENERAL REQUIREMENTS

1.01 SUMMARY

A. This Section includes cold-applied, emulsified-asphalt dampproofing applied (but not limited to) the following surfaces:

1. Exterior, below-grade surfaces of concrete foundation walls including elevator pit walls.

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.03 REFERENCE

A. American Society of Testing and Materials (ASTM)

D146 Test Methods of Sampling and Testing Bitumen-Saturated Felts and Woven Fabrics for Roofing and Waterproofing.

D490 Specification for Road Tar.

D1227 Specification for Emulsified Asphalt Used as a Protective Coating for Roofing

1.04 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of product specified, including data substantiating that materials comply with requirements for each dampproofing material specified. Include recommended method of application, recommended primer, number of coats, coverage or thickness, and recommended protection course.

C. Certification by dampproofing manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed bituminous dampproofing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

Single-Source Responsibility: Obtain primary dampproofing materials and primers from one source and by a single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

1.06 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit asphalt dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has thoroughly cured.

C. Proceed with dampproofing work only after substrate construction and penetrating work have been completed.

PART 2 - MATERIALS

2.01 COLD-APPLIED ASPHALT EMULSION DAMPPROOFING

A. Asphalt Emulsion: Asphalt-and-water emulsion coating, compounded to penetrate substrate and build to moisture-resistant coating.

1. Provide semifibrated-type semimastic asbestos-free emulsion; ASTM D 1227, Type II, except containing nonasbestos fibrous reinforcement and filler materials.

a. Trowel Coats: ASTM D 1227, Type II, Class 1.
b. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.
c. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

B. Manufacturer: Subject to compliance with requirements, provide products of one of the following systems:

1. Carlisle – CCW Waterproofing and Protection Board V
2. BASF./Sonneborn Building Products Div. – Sonoshield HLM 5000 and Protection Course II
3. W.R. Grace – Bituthene System 4000
4. Henry Company - No. HE789 and EPS Board
5. Karnak Chemical Corporation - No. 220AF and EPS Protection Board
6. Tamko Corporation – Foundation Coating and Protection Board; TW-60 membrane
7. Tremco, Inc. – Tuff-N-Dri XTS and Protection Board
8. Euclid Chemical Company (The). Tamoseal Foundation Coating
9. Meadows, W. R., Inc. – Hydrolastic 836

C. Odor Elimination: For interior and concealed-in-wall uses other than exterior face of inner wythe of cavity walls, provide dampproofing material warranted by manufacturer to be substantially odor free after drying for 24 hours under normal conditions.

2.02 MISCELLANEOUS MATERIALS

A. Glass-Fiber Mat: Nonwoven fiberglass fabric of continuous filament or jack-straw filament/yarn pattern of glass fiber, impregnated and bound together with type of organic/synthetic binder that is compatible with type of bituminous compound indicated to be reinforced and as recommended by the bituminous dampproofing system manufacturer.

B. Protection Board: Provide lightweight, high-density, rigid, 1” thick EPS foam protection board as recommended by damp proofing membrane material manufacturer for all vertical below-grade damp proofing locations.

C. Bituminous Grout: ASTM D 146.

D. Plastic Cement: Asphalt based, complying with ASTM D 490, except provide coal tar base where specifically recommended by manufacturer of bituminous dampproofing materials.

E. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, with Applicator present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

B. Begin dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

B, Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.03 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

B. Apply additional coats if recommended by manufacturer or required to achieve coverages indicated. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

C. Apply dampproofing to footings, underside of slabs, and foundation walls where opposite side of surfaces building interior or occupied spaces whether indicated or not.

D. Extend 12 inches (300 mm) onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.

E. Install flashings and corner protection stripping at internal and external, changes in plane, construction joints, cracks, and where shown as “reinforced,” by embedding an 8 inch (200 mm) wide strip of asphalt-coated fabric in a heavy coat of dampproofing. Dampproofing coat required for embedding fabric is in addition to other coats required.

F. At below grade surfaces, install protection board of type indicated over completed-and-cured dampproofing treatment. Comply with dampproofing materials manufacturer's recommendations for method of support or attachment of protection materials. Support with spot application of plastic cement where not otherwise indicated.

3.04 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

END OF SECTION 07 11 13

SECTION 07 21 00 BUILDING INSULATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Interior Stud Wall Sound Batt Insulation
2. Exterior Stud Wall Cavity Insulation
3. Exterior Continuous Insulation
4. Roof to wall transition insulation
5. Loose fill (polystyrene) insulation
6. Roof Insulation – Refer to Division 07.

1.02 REFERENCES

A. American Society of Testing and Materials (ASTM)

1. C578 Specification for Rigid, Cellular Polystyrene Thermal Insulation
2. C612 Standard Specification for Mineral Fiber Blanket Block and Board Thermal Insulation.
3. C665 Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
4. C549 Specification for Perlite Loose Fill Insulation
5. C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
6. E84 Test Method for Surface Burning Characteristics of Building Materials
7. E96/A96M Standard Test Method for Water Vapor Transmission of Materials
8. E119 Test Method for Fire Tests of Building Construction and Materials
9. E136 Test Method for Behavior of Material In A Vertical Tube Furnace At 750 Degrees C

B. Underwriter's Laboratories, Inc. (UL) Fire Resistance Directory

C. NFPA 285 Standard Fire Test Method for Evaluation of fire propagation characteristics of exterior non-load bearing wall assemblies containing combustible components

1.03 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Section 01 30 00.

B. Manufacturer's Certifications: Submit manufacturer's representative certification that the proposed products comply with specified requirements, and are compatible with each other and substrates for the intended applications.

C. Product Data Sheet: Submit manufacturer's catalog data and application instructions for each material proposed for use.

D. Recycle Content: Submit manufacturer's documentation of recycled content for glass fiber insulation

E. Safety Data Sheets (SDS): Submit SDS for each adhesive product.

1.04 QUALITY ASSURANCE

A. Single-Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products complying with requirements without delaying progress of the work.

B. Installer Qualifications: Engage an experienced installer, with not less than two (2) years experience and certification by the manufacturer as an approved installer, who has completed building insulation applications similar in material, design and extent to that indicated for projects that have resulted in construction with a record of successful in-service performance.

C. Fire Hazard Classification:
1. Noncombustible, tested to ASTM E136
2. Maximum flame spread/smoke developed rating of <25 / <450, tested to ASTM E84.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in manufacturer's original unopened packaging fully labeled and intact until time of use. Store materials off ground and under cover to prevent damage or contamination to materials by water, foreign matter or other causes. Promptly remove from site any materials which show evidence of damage and immediately make all replacements necessary.

1.06 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of insulation under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by insulation manufacturer.

2. When insulation is or is likely to become wet due to rain, frost, condensation or other causes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, products by manufacturers that may be incorporated in the work include, but are not limited to the following. However, it is the Contractor's responsibility to provide only products compatible with the adjacent materials in the assembly.

1. Rock Wool Board Insulation
(Continuous insulation at exterior walls, below exposed floors and as continuous Fire-Blocking at floor lines where required)
Minimum LTTR value of R-4.3 per inch thickness, Provide minimum R-8.6, unless noted otherwise

a. Thermafiber Rainbarrier or architect approved equal
b. Minimum 4#/cu ft where used as fire blocking

2. Polyisocyanurate (Polyiso) Board Insulation
(Continuous insulation at exterior walls, Insulated Concrete Tilt-Walls, below exposed floors.)
Minimum LTTR value of R-6.5 per inch of thickness, Provide minimum R-11.4, UNO.

a. Atlas Roofing Corporation - EnergyShield PRO
b. Carlisle - R2 + Sheathe
c. Firestone - Enverge Ci Foil
d. Hunter - Xci CG Class A
e. StaRgard Plus R-5 – StarRFoam, Inc.

3. Glass-Fiber Blanket/Batt Insulation (unfaced)
(Stud cavity thermal and acoustic insulation)
Minimum R value of R-11 for 3.5" thickness and R-19 for 6.25" thickness. Provide minimum R-19 at exterior stud wall cavities, unless noted otherwise.

a. CertainTeed Corp. - AcoustaTherm
b. Knauf Fiberglass - QuietTherm Insulation
c. Owens-Corning Fiberglass Corp. - Thermal Batt Insulation
d. Johns, Manville - Therma Shield Thermal Insulation
e. Guardian Fiberglass, Inc. - Thermal and Sound Control Batts

4. Perlite Loose-Fill Insulation (at locations indicated on the drawings)

a. Producer members of Perlite Institute, Inc.
b. Thermo-Rock West, Inc.
c. Persolite Products, Inc.

2.02 MISCELLANEOUS MATERIALS

A. Adhesive for Bonding Insulation: Provide insulation manufacturer's recommended low-volatile organic compound (VOC) adhesives in compliance with California South Coast AQMD Rule 1168, capable of bonding insulation to substrates indicated without damaging or corroding either insulation or substrates. Applicable VOC limits include but are not limited to:

1. Contact Adhesive: Not to exceed 80 grams per liter (less water)
2. Special Purpose Contact Adhesive: Not to exceed 250 gramps per liter (less water)
3. Multipurpose Construction Adhesive: Not to exceed 70 grams per liter (less water)
4. Plastic Foam Adhesive: Not to exceed 50 grams per liter (less water)

B. For adhesive applications not listed above, comply with AQMD Rule 1168. Unless otherwise specified in AQMD Rule 1168, VOC content of adhesives shall not exceed 250 grams per liter (less water).

C. Mechanical Fasteners: Provide insulation manufacturer's recommended fasteners for required substrate and application.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Verify that conditions comply with requirements of Contract documents. Verify that related work to be performed before installation of insulation within indicated spaces has been completed. Verify that substrates are in satisfactory condition to receive insulation.

B. Masonry substrates: Verify that masonry materials have dried sufficiently and have attained optimum moisture content.

C. Do not proceed with installation of insulation until all unsatisfactory conditions have been corrected.

D. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections that might puncture vapor retarders, or interfere with insulation attachment.

E. Close off openings in cavities receiving poured-in-place insulation to prevent the escape of insulation. Provide screens where openings must be maintained for drainage or ventilation.

F. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

G. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

H. Do not install insulation which is damaged, wet or soiled.

I. Locate vapor retarders on the warm side of assembly, unless indicated otherwise on Contract documents or manufacturer's data sheets.

J. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions.

K. Protect below-grade insulation on vertical surfaces from damage during back-filling, by application of protection board. Set in adhesive in accordance with recommendations of insulation manufacturer.

L. Cut insulation neatly as required to fit tightly around obstructions.

M. Butt board edges and ends tightly. Form solid joints where insulation boards meet protrusions and between adjacent boards. Stagger joints.

N. Install per manufacturer's recommendations and installation sequence. Provide permanent placement and support of insulation.

O. Use blanket widths and lengths that fill cavities formed by framing members. Where more than one (1) length is required to fill cavity, provide lengths that will produce snug fit at ends.

P. Cut installation neatly as required to fit tightly around obstructions.

Q. Fasten insulation continuously tight against framing members to completely fill all spaces.

R. Seal tight all joints and gaps, with tape to ensure airtight installation. Install in a manner to prevent sagging.

S. Provide metal clips or wire bracing for supplemental support of vertical heights over 10 feet (3 m). Any insulation that does not fill the cavity width shall have support in the form of metal clips or wire bracing.

3.02 INSTALLATION OF CAVITY WALL

A. Seal holes and openings in cavities as necessary to prevent loss of insulation during construction.

B. Install fire blocking per NFPA 285 at continuous insulation at floor lines of exterior walls. Fire-blocking shall consist of 4#/cu ft. Mineral Wool equal to Thermafiber. Blocking shall be fastened at floor lines with Z-clips.

3.03 INSTALLATION, SPECIFIC LOCATIONS

A. Blanket (Batt) Insulation: Installation of insulation must be in continuous coverage in neat finished appearance; no sagging or gaps between layers. Insulation shall be installed in straight, even planes.

1) Wall Insulation: Install 4” and/or 6” insulation continuous from bottom track to top of wall in all exterior wall areas.

2) Sound Insulation: Install 4” insulation in all metal stud walls around restrooms, classrooms, conference rooms, labs, offices, clinic/nurse areas, around all music spaces (including band and choir, rehearsal), mechanical air-handling equipment rooms and other areas shown on the drawings for sound insulation. Continue insulation to top of walls.

B. Rigid Insulation: Install insulation board with adhesive direct to sheathing using manufacturer’s recommended adhesive. Installation shall provide complete coverage on all surfaces with no unsealed voids or gaps allowed.

1) Any voids or gaps shall be sealed with waterproof tape as recommended by insulation manufacturer. Special attention shall be given to sealing joints between sheathing and insulation and insulation and other dissimilar materials.

3.04 PROTECTION

A. General: Protect installed insulation and vapor retarder from damage due to harmful weather exposures and from construction damage. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

3.05 CLEANING

A Remove all excess materials from the job site and leave the areas insulated ready for other trades.

B. Prevent disposal of insulation scraps by reuse in ceiling and wall areas or other locations out of view.

C. Remove all unusable excess materials from the job site and leave the areas insulated ready for other trades.

END OF SECTION 07 21 00

SECTION 07 21 19 FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Closed-cell spray polyurethane foam insulation.
2. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each product, for tests performed by qualified testing agency.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. (24 kg/cu. m) and minimum aged R-value at 1-inch (25.4-mm) thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F (25 mm of 43 K x sq. m/W at 24 deg C).
1. Provide minimum thickness of 3” unless noted otherwise in the drawings.
2. Acceptable Manufacturers:
a. Carlisle Spray Foam Insulation.
b. Gaco; Holcim Building Envelope.
c. Huntsman Building Solutions.
d. Johns Manville; a Berkshire Hathaway company.
e. Master Builders Solutions.

B. Product Properties:
1. R-Value 6.9 @ 1"; 21 @ 3"; ASTM C-518

2. Core Density 2.0 LB / Cubic Foot; ASTM D-1622
3. Closed Cell Content > 90%; ASTM D-2856
4. Sound Transmission Coefficient 41; ASTM E-90-85/E 413
5. Water Absorption < 2% by volume; ASTM D-2842
6. Water Vapor Transmission Permeance:
   a. 0.8 perms @ 1"; 0.23 perms @ 3.5"; ASTM E-96
7. Air Impermeable < 0.02 (L/s-m2) @ 1"; ASTM E-2178
8. Tensile Strength (PSI) 60; ASTM D-1623
9. Dimensional Stability < 9%; ASTM D-2126
10. Compressive Strength 47; ASTM D-1621
11. Fungi Resistance Zero Rating; ASTM G-21

C. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

D. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

3.2 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Cavity Walls: Install into cavities to thickness indicated on Drawings.

F. Miscellaneous Voids: Apply according to manufacturer's written instructions.

G. Apply barrier coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.

1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.

2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.

3. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect spray foam insulation installation, including accessories. Report results in writing.

3.4 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 21 19

SECTION 07 26 00 FLUID APPLIED AIR BARRIER

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This Section specifies a water resistant fluid applied air barrier in exterior wall assemblies including but not limited to these locations:

1. Foundation and walls, including penetrations, ties and anchors.
2. Walls, windows, curtain walls, storefronts, louvers or doors.
3. Different wall assemblies, and fixed openings within those assemblies.
4. Wall and roof connections and penetrations.
5. Floors over unconditioned space.
6. Walls, floor and roof across construction, control and expansion joints.
7. Walls, floors and roof to utility, pipe and duct penetrations.
8. Seismic and expansion joints.
9. All other leakage pathways in the building envelope.

1.2 PERFORMANCE REQUIREMENTS

A. Material Performance: Provide materials which have a vapor permemance of 10.0 US perms or greater.

1.3 SUBMITTALS

A. Submit in accordance with Division 1 requirements.

B. Product Data: Submit manufacturer's product data, installation instructions, and manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

C. Submit letter from primary materials manufacturer indicating approval of products not manufactured by primary manufacturer.

D. Include statement that materials are compatible with adjacent materials proposed for use.

E. Submit manufacturer's specifications and other data needed to prove compliance with specified requirements.

F. Submit manufacturer's installation instructions and manufacturer's affidavit that materials used in Project contain no asbestos, lead, or PCB's.

G. Submit reports indicating that field peel-adhesion test on all materials to which sealants are adhered have been performed and the changes made, if required, to other approved materials, in order to achieve successful adhesion.

H. Samples: Submit clearly labeled samples, 3 by 4 inch minimum size of each material specified.

I. Shop Drawings of Mock-Up: Submit shop drawings of proposed mock-ups showing plans, elevations, isometric details, installation sequence, and connections to the test apparatus.

J. Field Test Results of Mock-Up: Submit test results of air leakage test and water leakage test of mock-up in accordance with specified standards, including retesting if initial results are not satisfactory.

K. Shop Drawings: Submit shop drawings showing locations and extent of air barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the air barrier are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.

1. Include VOC content of each material, and applicable legal limit in the jurisdiction of the project.
2. Include statement that materials are compatible with adjacent materials proposed for use.
3. Include recommended values for field adhesion test on each substrate.

L. Compatibility: Submit letter from manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from manufacturer stating that cleaning materials used during installation are chemically compatible with each of the adjacent materials proposed for use. Submit letter from manufacturer for certification of compatibility with rigid insulation specified in Section 07 21 00.

1.4 QUALITY ASSURANCE

A. Air Barrier Installer Qualifications: Currently accredited by the Air Barrier Association of America (ABAA) whose applicators are certified in accordance with the ABAA Quality Assurance Program.

B. Manufacturer: Obtain primary materials from a single manufacturer regularly engaged in manufacturing air barrier membranes. Obtain secondary materials from a source acceptable to the primary materials manufacturer.

C. Accredited Laboratory Testing for Materials: Laboratory accredited by International Accreditation Service Inc. (IAS), American Association for Laboratory Accreditation (A2LA), or the Standards Council of Canada (SCC).

D. VOC Regulations: Provide products which comply with applicable regulations controlling the use of volatile organic compounds for the specific authority having jurisdiction.

1.5 PRE-CONSTRUCTION MEETING

A. Preconstruction Meeting: Convene a minimum of two weeks prior to commencing Work of this Section.

1. Agenda shall include, at a minimum, construction and testing of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction.

2. Attendance is required by representatives of related trades including covering materials, substrate materials and adjacent materials.

1.6 FIELD QUALITY CONTROL

A. Do not cover air barrier until it has been inspected, tested and accepted.

B. Mock-Ups: Build mock-up representative of primary exterior wall assemblies and glazing assemblies including backup wall and typical penetrations as acceptable to the Architect.

C. Mock-up shall be approximately 8 feet long by 8 feet high and include the materials proposed for use in the exterior wall assembly. Mock-up shall be suitable for testing as specified in the following paragraph.

D. Mock-Up Tests for Air and Water Infiltration: Test mock-up for air and water infiltration in accordance with ASTM E 1186 (air leakage location) or ASTM E 783 (air leakage quantification), and ASTM E 1105 (water penetration).

E. Use smoke tracer to locate sources of air leakage. If deficiencies are found, repair or modify mock-up and retest until satisfactory results are obtained. Deficiencies include air leakage beyond values specified, uncontrolled water leakage, unsatisfactory workmanship.

1. Perform the air leakage tests and water penetration test of mock-up prior to installation of cladding and trim but after installation of all fasteners for cladding and trim and after installation of other penetrating elements. For fasteners which would normally only be installed with cladding, install representative fasteners without cladding; intent is to perform testing with all types of penetrations in place.

F. Mock-Up Tests for Adhesion: Test mock-up of fluid applied and sheet applied materials for adhesion in accordance with ASTM 0 4541 using a Type 1 pull tester except that the disk used shall be 100mm in diameter and the membrane shall be cut through to separate the material attached to the disk from the surrounding material.

1. Perform test after curing period recommended by the manufacturer. Record mode of failure and area which failed in accordance with ASTM 0 4541.

2. When the air barrier material manufacturer has established a minimum adhesion level for the product on the particular substrate, the inspection report shall indicate whether this requirement has been met. Where the manufacturer has not declared a record the value.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier membrane manufacturer. Protect stored materials from direct sunlight.

C. Handle materials in accordance with manufacturer's recommendations.

1.8 PROJECT CONDITIONS

A. Temperature: Install air barrier within range of ambient and substrate temperatures recommended by air barrier manufacturer.

B. Field Conditions: Do not install air barrier in snow, rain, fog, or mist without temporary protection and supplemental heat as required. Do not install air barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer. Apply membrane to a surface dry substrate, or in accordance with manufacturer's recommendations.

1.8 WARRANTY

A. Material Warranty: Provide manufacturer's standard product warranty, for a minimum 10 years from date of Substantial Completion.

B. Installation Warranty: Provide air barrier subcontractor's 2 year warranty from date of Substantial Completion, including all components of the air barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, failure to cure properly.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fluid Applied Air Barrier: Fluid applied proprietary materials as specified. Use regular or low-temperature formulation depending on site conditions, within temperature ranges specified by manufacturer. Provide related accessories including primer, seam tape, mastic, fluid and sealant recommended by manufacturer. Subject to compliance with requirements, provide one of the following:

1. Carlisle Coatings and Waterproofing – Fire-Resist Barritech NP, 70 to 80 mil thick
2. Grace Construction Products – Perm-A-Barrier Liquid, 60 mil thick (wet)
3. Henry Company – Air Bloc 32MR, 75 to 115 mil thick (wet)
4. TK Products – TK AirMax 2102 VOC, 40-45 mil (wet), 22-25 mil (dry) or AirMax 2103 water based, 40 mil (wet)
5. W.R. Meadows, Inc. – Air Shield LM, 60 mil (wet) 45 mils (dry)

B. Provide all related system recommended flashing, counterflashing, fabric reinforcement, primer, mastic, fill compound, transition strips, adhesive, tapes, caulking, sealants as required for a complete watertight installation.

2.2 AUXILIARY MATERIALS

A. Membrane at Transitions in Substrate and Connections to Adjacent Elements: Neoprene, ASTM D 2000 Designation 2BC415 to 3BC620, 50 to 65 mils (1.3 mm to 1.6 mm) thick with non-corrosive termination bars and fasteners. Adhesive and lap sealant as recommended by manufacturer.

B. Transition Membrane Between Air Barrier Membrane and Roofing and Other Adjacent Materials: Comply with both air barrier manufacturer's recommendations and roofing material manufacturer's recommendations.

C. Provide primers, glass fabric scrim tape, mastic, and other materials not specifically described, but required for a complete and proper installation as instructed by the dampproofing manufacturer or required.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions under which air barrier assemblies will be applied, with Installer present, for compliance with requirements.

1. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

2. Do not proceed with installation until after minimum concrete curing period recommended by air barrier manufacturer.

3. Ensure that the following conditions are met:

   a. Surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
   b. Concrete surfaces are cured and dry, smooth without large voids, spa lied areas or sharp protrusions.
   c. Masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.

4. Verify substrate is surface dry. Test for capillary moisture by plastic sheet method according to ASTM D 4263 and take suitable measures until substrate passes moisture test. Surface dry is an acceptable substrate condition if acceptable to the manufacturer.

5. Verify sealants used in sheathing are compatible with membrane proposed for use. Perform field peel-adhesion test on materials to which sealants are adhered.

6. Notify Architect in writing of anticipated problems using air barrier over substrate prior to proceeding.

3.2 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application. Mask off adjoining surfaces to prevent overspray and spillage.

B. Surface Preparation (Masonry): Dust, dirt, old loose or scaling coatings should be removed from the surface before coating.

1. Cracks, joints, penetrations, and splits should be sealed, repaired with four (4) inch wide glass fabric scrim tape embedded in Henry #789, or manufacturers approved equal.

2. Dusty or porous masonry surfaces should be dampened with water. Highly porous masonry should be primed with Henry #792 Penetrating Asphalt Primer or #788 Non-Fibered Asphalt Emulsion Dampproofing which has been thinned with one (1) gallon water per five (5) gallons of #788, or manufacturers approved equal.

3. Cleaned metal surfaces should also be primed. Architect must approve the surface preparation and sealing of cracks, joints and other penetrations prior to the application of the dampproofing.

C. Surface Preparation (Sheathing): Prep joints and penetrations in exterior sheathing per sheathing manufacturer's instructions.

D. Prime substrate for application of sheet membrane transition strips as recommended by manufacturer and as follows:

1. Prime masonry, concrete substrates with conditioning primer.
2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond, with adequate drying time between coats.
3. Prime wood, metal, and painted substrates with primer.
4. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air barrier and at protrusions.

E. Prime substrate for application of fluid applied air barrier if recommended by manufacturer based on project conditions and as follows in Installation subsection.

3.3 INSTALLATION

A. Air Barrier Installation: Install transition strip materials and fluid applied air barrier to provide continuity throughout the building envelope. Install materials in accordance with manufacturer's recommendations and as follows, unless manufacturer recommends other procedures in writing based on project conditions or particular requirements of their recommended materials:

1. Apply under normal working conditions above 45 degrees F and rising. Do not apply when rain is imminent.

2. Apply with brush or spray equipment. Soft brushes free from stiff bristles should be used and the material applied in even strokes. When spraying, apply in one coat with a 50% overlap of the spray pattern to obtain a uniform and continuous coating, carrying coating in and around joints, grooves, and slots, following reveals and soffits of windows, and continuing 12 inches out on adjoining partitions and soffits as instructed by manufacturer.

3. Insure continuous coating free of breaks, voids and pinholes.

4. Thoroughly cover all cracks, joints, and corners.

5. Provide fluid applied air barrier and transition strips in all exterior cavity walls on concrete masonry units, and on all exterior sheathing including, but not limited to, areas above soffits, doors and windows, and behind stucco and plaster.

6. Apply primer for transition strips at rate recommended by manufacturer. Allow primer to dry completely before transition strip application. Apply as many coats as necessary for proper adhesion.

7. Apply primer for fluid applied air barrier as recommended by fluid applied air barrier manufacturer. Based on manufacturer's recommendation, no primer may be required for the fluid applied materials.

8. Apply fluid applied air barrier using equipment and methods recommended by manufacturer, to achieve a dry film thickness as recommended by the manufacturer.

9. Apply fluid applied air barrier and transition strips to shed water naturally without interception by a sheet edge, unless that edge is sealed with permanently flexible termination mastic.

10. Position subsequent sheets of transition strips applied above so that membrane overlaps the membrane sheet below by a minimum of 2 inches (50 mm), unless greater overlap is recommended by manufacturer. Roll into place with roller.

11 . Overlap horizontally adjacent pieces of transition strips a minimum of 2 inches (50 mm), unless greater overlap is recommended by manufacturer. Roll seams with roller.

12. Seal around all penetrations with termination mastic, extruded silicone sealant, membrane counterflashing or other procedure in accordance with manufacturer's recommendations.

13. Connect air barrier in exterior wall assembly continuously to the air barrier of the roof, to concrete below-grade structures, to windows, curtain wall, storefront, louvers, exterior doors and other intersection conditions and perform sealing of penetrations, using accessory materials and in accordance with the manufacturer's recommendations.

14. At changes in substrate plane, provide transition material (bead of sealant, mastic, extruded silicone sealant, membrane counterflashing or other material recommended by manufacturer) under membrane to eliminate all sharp 90 degree inside corners and to make a smooth transition from one plane to another.

15. Provide mechanically fastened non-corrosive metal sheet to span gaps in substrate plane and to make a smooth transition from one plane to the other. Membrane shall be continuously supported by substrate or as recommended by the manufacturer.

16. At through-wall flashings, provide an additional 6 inch wide strip of manufacturer's recommended membrane counterflashing to seal top of through-wall flashing to membrane or as recommended by manufacturer. Seal exposed top edge of strip with bead of mastic or as recommended by manufacturer.

17. At deflection and control joints, provide backup for the membrane to accommodate anticipated movement.

18. At expansion and seismic joints provide transition to the joint assemblies.

19. Apply a bead or trowel coat of mastic along membrane seams at reverse lapped seams, rough cuts, and as recommended by the manufacturer.

20. At end of each working day, seal top edge of the self-adhered membrane to substrate with termination mastic.

21 . Do not allow materials to come in contact with chemically incompatible materials.

22. Do not expose membrane to sunlight longer than as recommended by the manufacturer.

23. Inspect installation prior to enclosing assembly and repair punctures, damaged areas and inadequately lapped seams with a patch of membrane lapped as recommended by manufacturer.

3.4 FIELD QUALITY CONTROL

A. Cooperate with Owner's testing agency. Allow access to work areas and staging. Notify Owner's testing agency in writing of schedule for Work of this Section to allow sufficient time for testing and inspection. Daily inspection and testing may be required. Do not cover Work of this Section until testing and inspection is accepted.

B. Twenty (20) days after completion of this portion of the work, at the discretion of the Architect, demonstrate by running water test that the Work of this Section will successfully repel water.

1. Notify the Architect at least 72 hours in advance, and conduct the test in the Architect's presence.
2. By means of an outrigger, or similar acceptable equipment, place the nozzle of a 3/4 inch garden hose at a point approximately 10 feet-O inches away from top of wall where approved by the Architect, aiming the nozzle at slight downward angle to direct full stream of water onto wall.
3. Run water onto wall at full available force for not less than four (4) hours.
4. Upon completion of the four (4) hour period, inspect interior surfaces of wall for evidence of moisture penetration.

C. If evidence of moisture penetration is discovered, apply an additional coat of approved fluid applied air barrier and/or transition strips to exterior surface in areas directed by the Architect, repeating application and testing (at no additional cost to the Owner) until no evidence of moisture penetration is found.

3.5 PROTECTING AND CLEANING

A. Protect air barrier assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.

1. Coordinate with installation of materials which cover air membrane, to ensure exposure period does not exceed that recommended by the air barrier manufacturer.

2. Keep container tightly sealed and protect from freezing in shipping and storage.

B. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction and acceptable to the primary material manufacturer.

END OF SECTION 07 26 00

SECTION 07 42 13 PREFORMED METAL WALL PANELS

PART 1 - GENERAL

1.01 SCOPE

A. Provide and install complete, watertight, metal wall system as shown on drawings including panels, framing members, metal flashing, trim, accessories, and miscellaneous items as necessary for complete installation.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)
1. ASTM A 653: Steel Sheet, Zinc-Coated by the Hot Dip Process
2. ASTM A 792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process.
3. ASTM B 209: Aluminum and Aluminum Alloy Sheet and Plate.

B. Sheet Metal and Air Condition Contractors National Association, Inc. (SMACNA): Architectural Sheet Metal Manual, 2003 Edition.

C. American Iron and Steel Institute (AISI): AISI Cold Formed Steel Design Manual

D. Aluminum Association: Aluminum Design Manual

E. Metal Construction Association (MCA): Preformed Metal Wall Guidelines

F. Code References: ASCE-7, Minimum Loads for Buildings and Other Structures; IBC International Building Code

1.03 SYSTEM DESCRIPTION

A. Performance Requirements: Provide factory formed, prefinished, lappable, exposed fastener, structural, ribbed metal wall system, that has been pretested and certified by manufacturer to comply with specified requirements under installed conditions.
1. The metal siding system including required trim members shall meet the specified requirements for wind loads.

B. Structural Requirements: Engineer panels for structural properties in accordance with latest edition of American Iron and Steel Institute’s Cold Formed Steel Design Manual using “effective width" concept and Aluminum Association’s Aluminum Design Manual.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's specifications, standard profile sheet, product data brochure and finish warranty.

B. Shop Drawings: Shop drawings showing wall elevations with layout of panels, screws, underlayment and sections of each flashing/trim condition shall be submitted for approval prior to fabrication. Drawings shall contain material type, metal thickness and finish. Drawings shall distinguish between factory and field fabrication.

C. Samples:
1. Submit sample 12" long x full width panel, showing proposed metal gauge, seam profile and specified finish.

2. Submit manufacturers standard colors for Architect's selection.

D. Certification: Submit manufacturer's certification that materials and finishes meet specification requirements.

E. Test Reports: DMI Air and Water Infiltration Testing.

1. ASTM-E283 Air Test
2. ASTM-E331 Water Test

1.05 QUALITY ASSURANCE

A. Panel manufacturer shall have a minimum of ten (10) years of experience in manufacturing roofing and siding panels in a permanent stationary indoor facility.

B. Panel installer shall have a minimum of two (2) years experience in the installation of exposed fastener roofing and siding and show evidence of successful completion of at least three (3) projects of similar size, scope, and complexity.

1.06 DELIVERY, STORAGE, HANDLING

A. Panels and flashings shall be protected and properly packaged to protect against transportation damage in transit to the jobsite.

B. Upon delivery, exercise care in unloading, stacking, moving, storing, and erecting panels and flashings to prevent twisting, bending, scratching, or denting.

C. Store panels and flashings in a safe, dry environment under a waterproof covering to prevent water damage. Allow for adequate ventilation to prevent condensation. Panels and flashings with strippable film shall not be stored in direct sunlight.

D. Upon exposure to direct sunlight, immediately remove strippable film from panels and flashings. Protect panels and flashings from foot traffic and from all other trades.

1.07 PROJECT CONDITIONS

A. Field dimensions shall be taken prior to fabrication to verify jobsite conditions.

B. Maximum panel length is 40' (contact the factory for longer panels).

1.08 WARRANTIES

A. Panel manufacturer shall provide a twenty (20) year warranty on the paint finish covering chalking, cracking, checking, chipping, blistering, peeling, flaking, and fading.

B. Applicator shall furnish written warranty for a two (2) year period from date of substantial completion of building covering repairs required to maintain roof and flashings in watertight conditions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Wall Panels

1) General:
   a. Exterior wall panels shall be by Berridge Manufacturing Co.
   b. Refer to drawing sheet A6.01 for Basis of Design products.
   c. Substitutions: Refer to section 01 25 13:

2) Panel Description – “MP1”: Refer to drawing sheet A6.01

PART 3 - EXECUTION

3.01 PANEL APPLICATION

A. Structural system shall be plumb before wall panels are attached. Attach purlins to min. 22 ga. hat channel purlins.

B. Side laps shall be at least one full major rib with the underlying rib utilizing a supporting member bearing edge and the overlapping rib utilizing a continuous anti-capillary groove with sealant as recommended by manufacturer.

C. Panels shall be sealed at the base and at the eave according to manufacturer’s recommendations.

D. Flashing material shall be as follows:
(1) Base angle shall be galvanized steel as recommended by manufacturer, factory painted to match wall panels.

(2) All exterior trim shall be of the same type material and finish as wall panels except as noted otherwise.

E. Provide additional sealant as required for air/water tightness equal to Sonneborn Sonolastic one-part sealant.
1) Fasteners:
   a. Provide all fasteners to meet metal panel manufacturer’s installation guidelines.

   b. All base and eave structural connections shall be made in accordance with manufacturer’s recommendations.

   c. Intermediate girt connections shall be by manufacturer’s approved method.

   d. All exposed fasteners shall be same color as that selected on adjacent surfaces.

3.02 INSTALLATION

A. Contractor shall provide all flashing, accessories, and whatever is necessary to provide complete waterproof, non-leaking installation.

B. Accessories: Shall be standard by manufacturer and as otherwise noted and indicated on drawings. Flashing and accessories shall be fastened at max. 12" o.c. Resulting metal shall lie flat to surface with no raised gap.

C. Framing Member Installation:

1) Install all framing members level, square, and plumb to building lines.

2) Securely attach all framing members to building structural members by welding and bolting.

D. Panel Installation: Install all wall panels and soffit according to manufacturer's written instructions and shop drawings. Alignment shall be straight, square, and parallel with neat cuts. Uneven, ragged cut edges are prohibited.

1) All panels shall be factory cut-to-length according to the erection drawings as furnished by manufacturer.

2) Panels shall be continuous panel length; no end laps will be allowed unless the panel length exceeds 40'-0". Panel end laps shall be a minimum of 24" and sealed with bead of sealant. Symmetrical layout shall be used causing the end panels to have equal widths.

3) Panels, trim, fasteners, etc. shall be installed with proper tools in a workmanlike manner according to manufacturer's written directions.

4) Panel and soffit installation shall be square to building and all panels and trim aligned. All trim shall butt tightly and miter at corners.

E. Guarantees and Warranties

1) Manufacturer shall furnish its written manufacturer's warranty covering materials and workmanship of the metal building components for a period of five (5) years from date as evidenced on Final Application and Certificate for Payment.

2) Manufacturer shall furnish its written manufacturer's Color-Cote Guarantee covering the color finish of the wall panels and trim pieces for a period of ten (10) years from date as evidenced on Final Certificate for Payment.

END OF SECTION 07 42 13

SECTION 07 42 13.1 INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Prefinished steel wall and soffit panel system with concealed fasteners.
2. Steel furring channels related to metal wall panel installation.
3. Related flashings, trim, and accessory components.

1.2 REFERENCES

A. ASTM International:
1. ASTM A755/A755M - Standard Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Pre-painted by the Coil-Coating Process for Exterior Exposed Building Products.
2. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

1.3 PERFORMANCE REQUIREMENTS

A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable code.

B. Maximum Allowable Deflection of Panel: 1/180 of span.

C. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; deflection of structural support framing.

D. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.

1.4 SUBMITTALS

A. Section 01 33 01 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate dimensions, layout, joints, expansion joints, construction details, methods of anchorage, and interface with adjacent materials.

C. Product Data: Submit manufacturer’s product data for the specific panels.

D. Samples:
1. Submit two samples of each type panel and panel finish, 12 x 12 inch in size, illustrating panel profile and finish color, sheen, and texture.
2. Submit two samples of fasteners, closures, and other accessories.

E. Manufacturer’s Installation Instructions: Submit special procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years’ experience.

B. Installer: Company specializing in performing Work of this section with minimum three years’ experience and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store prefinished material off ground protected from weather, to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

D. Prevent contact with materials capable of causing discoloration or staining.

1.7 COORDINATION

A. Section 01 310 00 – Project Management and Coordination.

B. Coordinate Work with installation of wall sheathing and dampproofing.

C. Coordinate Work with installation of windows, doors, and adjacent components or materials.

1.8 WARRANTY

A. Section 01 77 00 - Closeout Procedures.

B. Special Fluoropolymer Finish Warranty: Submit a written warranty, signed by manufacturer, covering failure of the factory-applied exterior finish on metal wall panels within the specified warranty period and agreeing to repair finish or replace wall panels that show evidence of finish deterioration. Deterioration of finish includes, but is not limited to, color fade, chalking, cracking, peeling, and loss of film integrity.
1. Fluoropolymer Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Centria www.centria.com

B. Kingspan Insulated Panels, www.kingspan.com

C. Morin, www.morincorp.com.

D. Substitutions: Section 01 60 00 - Product Requirements.

2.2 PREFINISHED STEEL PANELS

A. Metal Panels:
1. Base Metal: Galvanized steel sheet ASTM A653/A653M; Structural Quality; G90 zinc coating. Minimum 22-gauge steel exterior face and 26-gauge steel interior face.
2. Configuration: Smooth-faced without grooves, ribs, or embossing. Interlocking weather tight edges and ends butted tight. Provide manufacturer’s vertical panel system as indicated in the drawings.
3. Concealed fastening system.

B. Insulating Core: Foamed-in-place expanded polyisocyanurate insulation providing thermal insulating value of:
Approximately 8 per inch per ASTM C518 @ 75˚F mean temperature
Approximately 9 per inch per ASTM C518 @ 35°F mean temperature

C. Panel Finish:
1. Exposed Finish System: Premium three-coat ASTM A755/A755M coil coating with 20-year finish warranty:
a. Manufacturer’s gripping primer.
b. 70% Kynar 500 or Hylar 5000 resin-based Fluropon color coat.
c. Clear topcoat for color and sheen retention.
d. Color(s) to be selected by the Architect.
2. Unexposed Finish: Manufacturer's standard coating.

D. Accessories: Provide with matching trim, closure pieces, and flashings: same material, thickness and finish as panels; brake-formed to required profiles.

E. Basis of Design:
1. *QuadCore Optimo Smooth™* as manufactured by Kingspan or approved equivalent in color, finish, sheen, configuration, and performance by specified manufacturer.
a. Panel sizes: 2-inch thick x lengths and widths as indicated in the drawings.
b. Designed for interlocking long edges and concealed fasteners; Panel ends concealed by matching trim where panel length exceeds manufacturer's single length capabilities, or as shown on drawings.

2.3 ACCESSORIES

A. Sealants: As specified in Section 07 90 00 and approved by the panel manufacturer; sealant color to match finish panels.

B. Fasteners: Manufacturer's concealed stainless steel or hot dip galvanized screws, threaded to suit application.

C. Field Touch-up Paint: As recommended by panel manufacturer.

D. Building Paper: Cellulose fiber building paper, water repellent breather type. ASTM D226; Type II, No. 30 unperforated asphalt felt.

2.4 FABRICATION

A. Form sections to match existing panels, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest practicable lengths.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination.

B. Verify air-barrier is in place and ready to receive metal wall panels.

3.2 INSTALLATION

A. Install panels in accordance with manufacturer's instructions using manufacturer's standard flashing and trim details unless modified by Drawings.

B. Where indicated, provide and install 16-ga. galvanized metal hat channel furring at maximum 16" o.c. over substrate.

C. Protect surfaces in contact with cementitious materials and dissimilar metals with bituminous paint. Allow to dry prior to installation.

D. At stud walls blind-fasten wall panels through sheathing into cold formed metal framing members; space fasteners maximum 16 inches on center horizontally and vertically to suit application.

E. Use proper tools to obtain controlled, uniform compression for positive seal without rupture of neoprene washer.

F. Field cutting panels by torch is not permitted.

G. Accessories: Install components necessary for complete wall panel assembly, including trim, flashings, sealants, gaskets, and similar items provided or recommended by panel manufacturer for complete and weather tight installation.

H. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4-inch in 20-feet on level, plumb, and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.3 ERECTION TOLERANCES

A. Limit variations from plumb and level:
   1. 1/8-inch in 20-feet-0 inches vertically and horizontally.
   2. 1/4-inch in 40-feet-0 inches either direction.

B. Limit offsets in theoretical end-to-end and edge-to-edge alignment:
   1. 1/16-inch from flush surfaces not more than 2-inches apart.
   2. 1/8-inch for surfaces more than 2-inches apart.

C. Tolerances shall not be accumulative.

3.4 CLEANING

A. Section 01 74 23 – Final Cleaning.

B. Remove site cuttings from finish surfaces.

C. Remove protective films from panel surfaces within 60-days of installation.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

END OF SECTION

SECTION 07 42 15 PREFORMED METAL SOFFIT PANELS

PART 1 - GENERAL REQUIREMENTS

1.01 SCOPE

A. Provide and install complete, watertight, metal wall system as shown on drawings including panels, framing members, metal flashing, trim, accessories, and miscellaneous items as necessary for complete installation.

1.02 WARRANTY

A. Manufacturer shall furnish its written manufacturer's warranty covering materials and workmanship of the metal building components for a period of five (5) years from date as evidenced on Final Application and Certificate for Payment.

B. Manufacturer shall furnish its written manufacturer's Color-Cote Guarantee covering the color finish of the soffit panels and trim pieces for a period of ten (10) years from date as evidenced on Final Certificate for Payment.

C. Panel design shall be in accordance with AISI "Specifications for the Design of Light Gauge, Cold Formed Steel Structural Members," and in accordance with sound engineering practice.

PART 2 - MATERIALS

2.01 MATERIALS

A. Soffit Panels – Basis of Design
1. Manufacturer: Certainteed
2. Product: Box Series – Exterior Soffits, Linear
3. Substitutions: Refer to section 01 25 13

B. Panel Description
1. Width: 8"
2. Length: Refer to drawings
3. Depth: 5/8"
4. Square edge design
5. MATERIAL: Aluminum
6. WEIGHT: Varies 0.5 – 1.0 lbs./sq.ft.
7. FIRE RATING: Class A Fire Rated per ASTM E84
   Painted or anodized metal: Flame spread: ≤ 25,
   Smoke ≤ 50
   Class A Fire Rated per CAN/ULC-S102
   Painted or anodized metal: Flame spread: ≤ 25,
   Smoke ≤ 50
8. SEISMIC RATING: Zones A,B,C,D,E,F
9. WIND LOAD: Per code
10. RECYCLED CONTENT: Up to 92%
    LIGHT REFLECTANCE (LR) COEFFICIENT
    PER ASTM E1264 & ASTM E1477
    Varies with finish
    Cotton White: LR = 0.81
11. WARRANTY: 1-year Limited Warranty.

C. Soffit panels shall be one piece from edge of building to edge of soffit as shown on drawings.

D. Panels shall be square cut and installed perpendicular to edge of building/edge of canopy.

E. Where soffit turns a corner, the soffit panels shall be cut to provide a mitered corner as shown on drawings.

PART 3 - EXECUTION

3.01 PANEL APPLICATION

A. Structural system shall be plumb before soffit panels are attached. Attach 1" subgirt, min 18 ga (sized and spaced as necessary to support load) to structural members.

B. Panels shall be sealed at the building and the edge fascia board according to manufacturer's recommendations.

C. Flashing material shall be as follows:

1. Edge trim where panels meet the building and the fascia of the roof. Also provide trim where mitered soffit meets as shown in drawings.

2. All exterior trim shall be of the same type material and finish as wall panels except as noted otherwise.

D. Provide additional sealant as required for air/water tightness equal to Sonneborn Sonolastic one-part sealant.

3.02 FASTENERS

A. Provide all fasteners to meet MBCI installation guidelines.

B. All base and eave structural connections shall be made in accordance with manufacturer's recommendations.

C. Install with concealed fastening system.

3.03 INSTALLATION

A. Contractor shall provide all flashing, accessories, and whatever is necessary to provide complete waterproof, non-leaking installation.

B. Accessories: Shall be standard by manufacturer and as otherwise noted and indicated on drawings. Flashing and accessories shall be fastened at max. 12" o.c. Resulting metal shall lie flat to surface with no raised gap.

3.04 FRAMING MEMBER INSTALLATION

A. Install all sub-girts, "C's," "Z's," or other framing members level, square, and plumb to building lines.

B. Securely attach all framing members to building structural members by welding and bolting.

3.05 PANEL INSTALLATION

A. Install all soffit panels according to manufacturer's written instructions and shop drawings. Alignment shall be straight, square, and parallel with neat cuts. Uneven, ragged cut edges are prohibited.

B. All panels shall be factory cut-to-length according to the erection drawings as furnished by manufacturer.

C. Panels shall be continuous panel length; no end laps will be allowed. Symmetrical layout shall be used causing the end panels to have equal widths.

D. Panels, trim, fasteners, etc. shall be installed with proper tools in a workmanlike manner according to manufacturer's written directions.

E. Soffit installation shall be square to building and all panels and trim aligned. All trim shall butt tightly and miter at corners.

END OF SECTION 07 42 15

SECTION 07 52 19 MODIFIED BITUMEN “COOL ROOF” MEMBRANE ROOFING SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. The installer shall coordinate the work of the entire roofing assembly, including, but not limited to:
   1. Tapered edge strips, cant strips, and wood nailers. (Refer to this Section and Section 06 10 00)
   2. Curbs, (Refer to Section 07 72 00)
   3. Modified bitumen membrane roofing
   4. Flashings, including sheet metal perimeter edge (fascia) (Refer this Section and Section 07 62 00)
   5. Walkway pads, expansion joints, and other work incidental to, the complete and proper installation of a watertight modified bitumen membrane roofing system as shown on the drawings or specified herein, and in accordance with all applicable requirements of the Contract Documents.

B. It is the intent of this Section that the Work shall:
   1. provide a watertight facility;
   2. conform to all applicable building code requirements and of authorities having jurisdiction;
   3. include Section 07 62 00, Sheet Metal Flashing, Downspouts, Gutters and Trim, and Section 07 72 00, Roof Accessories as part of the Work of this Section; and
   4. Provide Owner with a single source full system warranty as specified.

1.3 RELATED WORK

A. All Sections of Work relating to the roofing system, including mechanical, plumbing and electrical items penetrating the roof system.

1.4 REFERENCES

A. ASTM International (ASTM)
   1. C728, Standard Specification for Perlite Thermal Insulation Board
   2. C920, Standard Specification for Elastomeric Joint Sealants
   3. C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
   4. D41, Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
   5. D312, Standard Specification for Asphalt Used in Roofing
   6. D4479, Standard Specification for Asphalt Roof Coatings - Asbestos-Free
   7. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free
   8. D4897, Standard Specification for Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
   9. D5147, Standard Specification for Standard Test Methods for Sampling and Testing Modified Bituminous Sheet Material
   10. D6163, (D5147 & D146) Standard Specification for Styrene Butadiene Styrene

(SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements

B. ASCE-7 Wind uplifts requirements for geographical area.

C. Federal Specifications (FS)
1. TT-S-00230C

D. National Roofing Installers Association (NRCA)
1. Roofing and Waterproofing Manual - Latest Edition

E. Sheet Metal and Air Conditioning Installers National Association, Inc. (SMACNA)
1. Architectural Sheet Metal Manual - Latest Edition

F. Underwriters’ Laboratories (UL)
2. Fire Hazard Classifications

G. International Building Code

1.5 SUBMITTALS

A. Product Data: Manufacturer’s printed instructions, schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, fastener pattern layout, and accessories to be used in the Work.

B. Certifications:
1. Manufacturer’s written certification that installer is approved and licensed to install specified roofing system. **(Submit a copy with Proposal Form).**
2. Manufacturer’s affidavit that materials used in Project contain no asbestos.
3. Installer shall submit resume and project experience list for proposed system for Project Manager and job site superintendent.
4. Installer shall submit written certification that there are no undocumented workers being employed by them or by any subinstaller on this project and that all workers on this project are covered by workmen’s compensation.
5. Installer shall submit list of all subinstallers with evidence of subinstaller’s insurance coverage in compliance with contract requirements.
6. Manufacturer’s written certification of approval / acceptance of these specifications and details.

C. Referenced Standards: Two (2) copies of each referenced standard and retain approved copies at site.

D. Project Registration “Pin” proving the project has been registered with Manufacturer.

E. Shop Drawings: Furnish from copies of the manufacturer’s literature or from copies of NRCA “Roofing and Waterproofing Manual”, Latest Edition.
1. Furnish for approval any proposed details which differ from those included with this proposal package. All proposed details shall first be approved in writing by roofing manufacturers prior to submitting to Architect for approval.
2. Furnish detail project sequencing, staging, material loading, manpower plans, and project construction schedule for approval.

F. Samples:
1. Furnish copy of sample warranty that is to be issued upon project completion.

G. Temperature Charts: Bitumen heating devices 24 hour temperature charts.

H. Test Reports: Bitumen manufacturer’s test reports relative to the following for each batch of bitumen furnished:
   1. Softening Point: ASTM D312.
   2. Flashpoint: ASTM D92.
   3. Acceptable Bitumen Temperature: As recommended by the bitumen manufacturer and EVT label on containers.
   4. Thermometers: Two (2) hand held, “8F” thermometers complying with ASTM E1 to Architect for his checking kettle temperature.

I. Upon Substantial Completion of Work, submit the following to Architect for his submission to Owner:
   1. Manufacturer’s Warranty: Manufacturer’s written warranty as specified.
   2. Maintenance Procedures: Three (3) copies of Manufacturer’s printed instructions for Owner’s use regarding care and maintenance of roof.

J. Certificate of Analysis: Provide manufacturer’s printed certificate of analysis for all materials used. Attach copy with final warranty.

1.6 INSPECTIONS / TESTS

A. The Owner’s, Architect’s, and Manufacturer’s representative shall at all times have access to the job site and work areas. The installer will provide proper and safe facilities for such access and inspection.
   1. Architect Inspections:
      a. The Architect will be providing periodic inspections throughout the duration of the project. Architect's Representative shall be required to inspect after completion of each major phase of construction for approval.
   2. Manufacturer Inspections:
      a. An inspection shall be made by a representative of the material manufacturer at appropriate intervals during performance of Work to ensure that said project is installed in accordance with the manufacturer's specifications and illustrated details. Written reports by the manufacturer shall be turned over to the Architect, on each Monday following the prior week.
      b. The authorized material Manufacturer's field representative shall be responsible for:
         1) Keeping the Architect's representative informed after periodic inspections as to the progress and quality of the work observed.
         2) Calling to the attention of the installer those matters observed which are considered to be in violation of the contract requirements.
         3) Reporting to the Architect's representative, in writing, any failure or refusal of the installer to correct unacceptable practices called to his attention.
         4) Confirming, after completion of the work and based on his observation and test, that he has observed no application procedures in conflict with these specifications. Final payment will not be released until the Architect has received all specified warranties.

B. Any failure by the Owner’s, Architect’s or Manufacturer’s Representative to detect, pinpoint, or object to any defect or noncompliance of these specifications of work in progress or completed work shall not relieve the installer, or reduce, or in any way limit, his responsibility of full performance of work required of him under these specifications.

C. Architect may require tests and inspections as necessary to verify quality of roofing materials and workmanship. Laboratory tests will be performed in accordance with ASTM standard procedures.
   1. Owner will select testing laboratory and will pay for Work required by testing laboratory.
   2. Retests for work which fail initial tests or inspections shall be paid by installer.

1.7 QUALITY ASSURANCE

A. Installer:
   1. Installer shall have approval by manufacturer of accepted roofing system for application and issuance of specified warranty for a minimum of three (3) years. Proof of license agreement dated at least three years prior to date of bid opening.
   2. Installer shall be an experienced single firm specializing in the type of roofing and sheet metal work specified, with a minimum of five (5) years of previous successful experience on projects similar in size and scope.
   3. Installer shall be certified and approved by manufacturer and licensed to install specified roofing system.
   4. No subcontracting of sheet metal fabrication or installation will be accepted. Installer must have a sheet metal shop on the company premises.
   5. Installers shall have a competent Superintendent, who is not actually performing roofing work, on site at all time while work is in progress, with full authority to act on behalf of the Installer as his agent.
   6. All workmen shall be covered by Workmen’s Compensation insurance (verify upon request) and thoroughly experienced in the particular class of work upon which employed. Use of undocumented workers will not be tolerated - No Exceptions.
   7. Installer shall ensure that base fastener pull out resistance tests on existing decks were performed and approved by Architect and coordinated with Roofing Consultant prior to starting roofing application.
   8. Roofing installer must have reached the highest level of qualifications from the Manufacturer they are providing material for (i.e. Master Select installer).

B. Regulatory Requirements:
   1. Classification by Underwriters’ Laboratories, Inc. as a Class A roof covering.
   2. Roofing system shall be installed in accordance with ASCE-7-10 wind uplift requirements for geographical location exposure B, 110 MPH 3-second gust wind speed zone and risk category III based on IBC building code requirements. Wind-resistance loads listed below have a safety factor of 2.0 incorporated into the calculation.
      a. Zone 1 Field -100.5 psf or as otherwise indicated by Structural
      b. Zone 2 Perimeter -132.5 psf or as otherwise indicated by Structural
      c. Zone 3 Corner -180.6 psf or as otherwise indicated by Structural
   3. Follow local, state, and federal regulations of safety standards and codes. Refer to applicable building code or International Building Code for roofing system installation requirements and limitations.

C. Laboratory Testing and Samples:
   1. Architect may require tests and inspections as necessary to verify quality of roofing materials and workmanship. Laboratory tests will be performed in accordance with ASTM procedures.
   2. Owner will select testing laboratory and will pay for Work required by testing laboratory. Installer shall assume all costs for extraction and patch of all samples.
   3. Re-tests for work which fail initial tests or installer shall pay inspections.

4. Installer shall correct all deficiencies in accordance with manufacturers recommended procedures at no cost to Owner.

D. Installation:
1. Unless otherwise indicated, the materials to be used in this specification are those specified and denote the type, quality, performance, etc. required. All proposals shall be based upon the use of the specified material.
2. Install materials in accordance with the manufacturer's current published application procedures and the general recommendations of the National Roofing Installer’s Association.
3. It will be the installer's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the installer shall be responsible for the correctness of it. Any drawings supplied are for reference only.
4. Installer shall plan and conduct the operations of the work so that each section started on one day is complete, details installed and thoroughly protected and in watertight condition before the close of work for that day.
5. Materials will be securely fastened in place in a watertight, neat and workmanlike manner. All workmen shall be thoroughly experienced in the particular class of work upon which employed. Work shall be performed in accordance with these specifications and shall meet the approval in the field of the Architect.
6. All waste materials, rubbish, etc., shall be removed from the Owner's premises as accumulated. Rubbish shall be carefully handled to reduce the spread of dust, and shall be deposited at an approved disposal site. At completion, all work areas shall be left broom clean and all installers’ equipment and materials removed from the site.

1.8 PERFORMANCE REQUIREMENTS

A. Fire Resistance: Meet Underwriter's Laboratory Class "A" fire rating.

B. Installer shall ensure that base fastener pull out resistance tests on new lightweight insulating concrete fill were performed and approved by Architect and coordinated with Roofing Consultant prior to starting roofing application.

1.9 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 – Project Coordination.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original unopened packaging with all tags and labels intact and legible. Carton and can labels shall indicate appropriate warnings, storage conditions, lot numbers, and usage instructions. Handle and store materials and equipment in such a manner as to avoid damage. The proper storage of materials is the sole responsibility of the installer. Materials damaged in shipping or storage shall not be used. Wet or damaged roofing materials shall be discarded, removed from job site, and replaced with new materials prior to application.

B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be accepted minimum for exterior coverings. All stored materials, as mentioned above, shall be minimum of four (4) inches off the substrate and the tarpaulin tied off with rope.

C. Products liable to degrade as a result of being frozen shall be maintained above 40° F in heated storage.

D. Moisture sensitive products shall be maintained in dry storage areas or properly covered. Roofing insulation and felts must always be covered or stored in a dry area when not being used.

E. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

1.11 WARRANTY / GUARANTEE

A. Roofing Manufacturer: Warrant the roofing and associated Work for 20 (30) years from date of Substantial Completion as follows:
1. The warranty shall be a NDL “No Dollar Limit” / no penal sum type, with total replacement cost.
2. The warranty shall guarantee the entire roof system and associated work against defective materials and workmanship of installation, with NO exclusion for ponding water.
3. The roof system including roofing insulation, flashing, penetrations, wall flaashings, metal work, labor, and material shall be guaranteed against failure of workmanship and materials. Repair of the system, including materials and labor, shall be done at no cost to the Owner.
4. Submit four (4) original executed copies of the Warranty / Guarantee.

B. Roofing Installer: Jointly with any subinstallers employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Architect accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the Installer, and subinstallers, to make good the requirements of the warranty. The warranty will be held jointly with the Bonding Company for the first two (2) years and the manufacturer for the remaining three (3) years.

C. Make arrangements with the materials manufacturer to provide the required warranty. Final warranty shall be submitted to Owner at time of Substantial Completion.

D. Submit attached Installer’s Warranty and Subinstaller’s Guarantee forms at Project Closeout.

PART 2 - PRODUCTS

2.1 APPROVED PRODUCTS/MANUFACTURERS

A. Unless noted otherwise, specifications are based on products of named manufacturers but should not preclude the Installer from using other manufacturers who produce products that meet or exceed the specifications. Manufacturers whose products meet or exceed the specifications, who have manufactured and installed roof materials and systems of the type specified for a minimum of ten (10) years, and who maintains a single source responsibility for the total roofing system, as described herein, may apply for approval as a substitution in accordance with Division 1 requirements regarding substitutions.
1. All materials shall be manufactured, specified, or accepted in writing by membrane manufacturer issuing the warranty. Proposed materials shall ensure full system warranty from said manufacturer. Installer shall be an installer licensed by the manufacturer.

2. Samples of all materials used on the project, which are not supplied by the membrane manufacturer, shall be submitted to the membrane manufacturer for written approval prior to starting work.
3. All materials used on the project shall be asbestos free.

B. Approved Manufactures:
1. Siplast, Inc., Irving, Texas; (972) 869-0070
2. Soprema, Wadsworth, OH; (800) 356-3521
3 Elevate Holcim (Formerly Firestone), Nashville TN; (800) 428-4442
4. Johns Manville, Denver, CO; (800) 654-3103

2.2 ROOFING SYSTEM ASSEMBLY/PRODUCTS

A. Modified Base Sheet: A fiberglass reinforced, Styrene-Butadiene-Styrene (SBS) modified asphalt coated sheet, having an average weight of 28 pounds per square.
1. Approved Product:
a. Siplast Product: Para Base, base sheet
b. Soprema Product: Sopra-G, base sheet
c. JM Product: Perma Ply 28, base sheet
d. Elevate Product: MB Base, base sheet

B. Dry Sheathing Paper: (For use as a slip sheet) Rosin coated, 5 lbs. per 100 sq. ft.

2.3 ROOF MEMBRANE ASSEMBLY

A. System Description: A roof membrane assembly consisting of two (2) plies of a prefabricated, reinforced, homogeneous polymer modified asphalt membrane, secured to specified insulation or substrate. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system. Installer option to install using hot asphalt “mopped”, cold adhesive, torched, or any combination – confirm special membrane types with manufacturer. Provide components of the roof membrane assembly meeting the following physical and mechanical requirements.

1. **Hot Asphalt Applied Modified Bitumen Base Ply:** Approximately 90 mil high performance modified bitumen base ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality modified bitumen and having the following properties:
a. Approved Product:
1) Siplast Product: Paradiene 20
2) Soprema Product: Elastophene Sanded 2.2
3) Elevate Product: SBS Base
4) JM Product: DynaBase

2. **Torch Applied Modified Bitumen Base Ply:** Approximately 120 mil high performance modified bitumen base ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality modified bitumen and having the following properties:
a. Approved Product:
1) Siplast Product: Paradiene 20 TG
2) Soprema Product: Elastophene Flam
3) Elevate Product: SBS Glass Torch Base
4) JM Product: DynaWeld Base

3. **Hot Asphalt Applied Modified Bitumen Finish Ply:** Approximately 130 mil or better high performance modified bitumen "cool roof" reflective white finish ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality Styrene-Butadiene-Styrene (SBS) modified bitumen, and having the following properties:
   a. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
   b. Surfacing: White ceramic chips
   c. Solar Reflectance (avg.): greater than 3 year aged .75
   d. Thermal Emnittance (avg.): greater than 3 year aged .75
   e. Solar Reflectance Index (avg.): greater than 3 year aged 64
   f. Approved Product:
   g. 1) Siplast Product: Paradiene 30 FR BW
   h. 2) Soprema Product: Elastophene LS FR GR SG
   i. 3) Elevate Product: SBS Glass FR Ultrawhite
   j. 4) JM Product: DynaGlas FR CR G

4. **Torch Applied Modified Bitumen Finish Ply:** Approximately 140 mil or better high performance modified bitumen "cool roof" reflective white finish ply consisting of a lightweight random fibrous glass mat impregnated and coated with high quality Styrene-Butadiene-Styrene (SBS) modified bitumen, and having the following properties:
   a. Approvals: UL Approved, FM Approved (products shall bear seals of approval)
   b. Surfacing: White ceramic chips
   c. Solar Reflectance (avg.): greater than 3 year aged .75
   d. Thermal Emittance (avg.): greater than 3 year aged .75
   e. Solar Reflectance Index (avg.): greater than 3 year aged 64
   f. Approved Product:
      1) Siplast Product: Paradiene 30 FR TG BW
      2) Soprema Product: Elastophene Flam LS FR GR SG
      3) Elevate Product: SBS Glass FR Torch Ultrawhite
      4) JM Product: Dynaweld Cap FR CR

5. Stripping Ply: Same as roof system base ply.

2.4 FLASHING MEMBRANE ASSEMBLY

A. A flashing membrane assembly consisting of two (2) plies of reinforced, polymer modified asphalt membrane (foil face flashing membrane can be used as substitute):
   6. Modified Bitumen Flashing Sheet: Same as roof system finish ply.

   7. Modified Bitumen Foil Faced Flashing Sheet (Substitute):
      a. Siplast Product: "Aluminum" Veral
      b. Soprema Product: Sopralast 50 TV "Alu"
      c. Elevate Product: SBS Metal Flash AL
      d. JM Product: DynaClad AL

   8. Reinforcing Ply: Same as roof system base ply.

2.5 ROUGH CARPENTRY

A. All nailers, cants and wooden curbs shall be No. 2 or better treated lumber selected to meet design details and field dimensions and requirements of Section 06 10 00, Rough Carpentry. MCQ and MCA only.

2.6 ROOFING SHEET METAL

A. Refer to Section 07 62 00, Sheet Metal Flashing, Gutters, Downspouts and Trim.

2.7 ROOF INSULATION

A. Roofing Insulation:

9. All insulation shall be approved in writing by the membrane manufacturer as to thickness, type, and manufacturer. All insulation must be approved for the specific application with UL and FM Global approval. Refer to Div. 3 for insulation in lightweight concrete.

2.8 ROOFING ACCESSORIES

A. Roofing Adhesives:

10. Mopping Asphalt: Asphalt that has been certified for full compliance with the requirements for Low Fume Type IV asphalt listed in Table I, ASTM D312. Each container or bulk shipping ticket shall indicate the equiviscous temperature EVT, the finished blowing temperature, FBT, and the flash point, FP.
    a. Approved Product: Trumbull Low Fume asphalt or as required by membrane.
11. Cold Adhesive (if applicable): An asphalt based adhesive formulated especially for adhering polymer modified asphalt roofing membranes and base plies. Adhere shall be UL & FM listed and approved.
    a. Soprema Product: FMA
    b. Siplast Product: PA-311 Adhesive
    c. Elevate Product: MB Cold Adhesive
    d. JM Product: MBR Cold Application Adhesive

B. Bituminous Cutback Materials:

12. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D41 requirements.
    a. Approved Product: PA-1125 Asphalt Primer manufactured by Siplast.
13. Mastics: An asphalt cutback mastic, reinforced with non-asbestos fibers, used as a base for setting metal flanges and conforming to ASTM D4586 Type II requirements.
    a. Approved Product: PA-1021 Plastic Cement manufactured by Siplast.

C. Caulking and Sealants:

1. VOC Content: Provide sealants and sealant primers for use inside the weatherproofing system that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    a. Nonmembrane Roof Sealants: 300 g/L; single component, high performance, elastomeric sealants conforming to ASTM C920 requirements.
    b. Modified Bituminous Sealants: 500 g/L
    c. Other sealants: 420 g/L

D. Ceramic Granules: No. 11 Grade Specification Ceramic granules of color scheme matching the granule surfacing of the finish ply.

E. Metallic Dust: A finely graded metal dust as supplied or approved by the membrane manufacturer, used for covering of bitumen overruns over the foil surfaced membrane.

F. Fasteners:
1. Shall be Factory Mutual approved and as recommended by the manufacturer for the specific application.
2. Fastener for Brick: Shall be 1/4 inch x 2 inches, stainless steel nail, one piece unit, flat head, as manufactured by Rawl Zamac Nailin, or approved equal.
3. Fastener for Wood: Shall be a #14 Factory Mutual approved fastener, fluorocarbon coated, with CR-10 coating. A minimum 0.200 inch diameter shank and 0.250 inch diameter thread. To be used with Factory Mutual approved, round pressure plates or bar, and having a fluorocarbon CR-10 coating, when subjected to 30 Kesternich cycles (DIN 50018) shows less than ten percent (10%) red rust which surpasses Factory Mutual Approval Standard 4470 as manufactured by Olympic Manufacturing Group, Inc., or pre-approved equal.
4. Lightweight Insulating Concrete Base Sheet Fasteners: Shall be approved by the fastener manufacturer, membrane manufacturer and FM for use with lightweight insulating concrete as follows:
   a. Fastener shall be a single unit, precision formed, of electro zinc coated steel having a 2.7 inch diameter rib reinforced cap and 1.7 inch long rectangular legs, designed to expand when fully driven into the lightweight insulating concrete. Fasteners for lightweight insulating concrete shall meet FM Standard 4470 requirements for corrosion resistance.
      1) Approved Product: "Zono-tite" Base Sheet Fasteners.
5. Roofing Nails: Stainless steel, 316, type, size as required to suite application, minimum 11 gauge with 3/8 inch diameter head, minimum 1-1/2 inches in length.
6. Dual Prong Fastener: Coated Steel tube with stainless steel Locking Staple.

G. Walkway Pads: A prefabricated, puncture resistant polyester core reinforced, polymer modified bitumen sheet material topped with a ceramic-coated granule wearing surface meeting the following physical and mechanical requirements:
1. Thickness: 0.217 inch
2. Weight: 1.8 lb./ft^2
3. Width: 30 inches
4. Approved Product: Paratread Roof Protection Material

H. Liquid Flashings: One-Part Liquid Flashing is a one-component polyurethane / bitumen resin that provides a liquid flashing solution for asphaltic roofing systems. Utilize fabric in three part system at all penetrations.

2.9 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Other materials shall be as shown, specified or required and be of the best grade for the proposed use as recommended by the manufacturer.
1. Expansion Joint: As detailed on drawings and outlined in NRCA and SMACNA manuals.
2. Low Level expansion joints, as noted on the drawings, to be fabricated similar to Situra Inc. "Red Line" Low level expansion joint details. Install as per manufactures recommendations and included in system warranty.
   a. Approved Substitute Soprema's "Sopra Joint". Install as per manufacturer's recommendations.

3. Sealant Backer Rod: Provide compressible rod stack of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable, non-absorptive material as recommended by sealant manufacturer for back-up of and compatibility with sealant. Where used with hot-applied sealant, provide heat-resistant type which will not be deteriorated by sealant application temperature as indicated.
4. Pipe Hangers and Supports: Provide and install all necessary supports for gas lines, conduit, chilled water lines, duct work, condensate lines, etc. Refer to Section 07 72 00, Roof Accessories.
5. Relief vents, lead and other sheet metal materials shall be as specified in Section 07 62 00, Sheet Metal Flashing, Gutters, Downspouts and Trim.
6. Cant Strips: Shall be wood fiber where used for non-structural purposes. Shall be treated solid wood where used for structural purposes meeting NRCA, Factory Mutual and Underwriters Laboratory guidelines. If solid wood cant is used where insulation exists, cant is to be toe nailed into treated solid wood nailer the same height as insulation.

PART 3 - EXECUTION

3.1 SITE CONDITIONS

A. Environmental Requirements:
1. Apply roofing in dry weather.
2. Do not apply roofing when ambient temperature is below 45 degrees F.
3. Refer to manufacturers recommendations.

B. Field Tests:
1. Deck Dryness Test: Test for dryness before applying roofing. Should rain occur during application, retest for dryness before continuing application.
2. Foaming: Heat one Pt. of specified bitumen to 350 degrees F; pour on surface to receive roofing felts. If bitumen foams, deck is dry enough to roof.
3. Stripability: Cool bitumen poured on deck to ambient temperature and strip from surface. If any portion strips clean from deck, surface is not dry enough to roof.

3.2 ROOFING AND FLASHING - GENERAL

A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of base sheet as a continuous operation.

B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.

C. General Installation:
1. Protect adjacent areas with tarpaulin or other durable materials.
2. Installer shall prevent overspray, and be responsible for parking lot areas and/or adjoining areas not part of this contract.
3. Installer shall provide three (3) hour firewatch after use of torch. A fire extinguisher shall be present on roof at all times during use of a torch.

4. Installer shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e. pitch dams, envelopes, and filler strips.
5. Prepare surfaces according to manufacturer's or installer's published instructions. All metal that is to receive bitumen, or come in contact with bitumen or adhesive, shall be first primed with appropriate primer. Use cleaning materials or primers necessary to render a clean and dry surface/substrate.
6. Prior to application of felts and membrane, all foreign matter, gravel, etc., shall be removed from the substrate. Gravel or debris between the substrate and plies is not acceptable.
7. Bitumen kettles or tankers shall have a visible thermometer and thermostatic control to provide positive monitoring of the bitumen temperature when it is heated in accordance with manufacturer's instructions. Circulate bituminous materials; do not allow bituminous materials to stand in luggers for long periods. Use insulated hot transport lines and luggers. Kettle shall be kept a minimum of 30 feet away from building, placed so that fumes, odors, and smoke, do not enter building through windows, doors, fresh air vents or similar entrances; are not directed towards freshly painted or anodized surfaces, glass or other glazing materials. Do not place kettle under trees or near vegetation. The assigned kettle man shall remain in close attendance, within 25 feet of ground level, while burners are lit. Kettle lids are to remain closed except for loading. Level of bitumen shall be kept within eight (8) inches from top of kettle.
8. Asphalt Bitumen Heating: Heat and apply bitumen in accordance with equiviscous temperature method ("EVT Method") as recommended by the manufacturer. Discard bitumen that has been held at temperature, exceeding finished blowing temperature (FBT) for a period exceeding three hours. Do NOT heat bitumen to a temperature higher than 25 degrees F (14 degrees C) below flash point.
9. Asphalt Temperatures: If the EVT information is not provided, the following asphalt temperature shall be observed. Maximum heating temperature shall be 525 degrees F. Minimum application temperature shall be 400 degrees F.
10. Asphalt Moppings: Ensure that all moppings do not exceed a maximum of 25 pounds per square. Mopping shall be total in coverage, leaving no breaks or voids.
11. Membrane Adhesive Application (If applicable): Apply cold adhesive in a smooth, even, continuous layer without breaks or voids at the rate of 1-1/2 gallons per square per ply. (The porosity of some substrates may require a heavier application to ensure full adhesion.) Refer to manufacturer’s requirements.
12. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
13. Wrinkles, buckles, kinks, fishmouths, and dry voids of felt on felt are not acceptable when laying felt and membrane.
14. Primed cant strips shall be installed at the intersection of the deck and the vertical surfaces.
15. All flashings shall be mechanically top-fastened with a termination bar a minimum of six (6) inches on center at the top leading edge, and be a minimum of eight (8) inches in height from finished membrane.
16. On slopes greater than one (1) inch in 12 inches, refer to NRCA and/or manufacturer's guidelines for backnailing procedures and follow the more stringent guidelines for all specified materials.
17. Correct all errors in application the same work day they occur, including voids, fishmouths, dry laps or spots, wrinkles, ridges, blisters, bare spots, improper application, physical damage and all work not meeting specifications.

3.3 NAILERS

A. Wooden nailers shall be installed at perimeter edges or drip edges on outside perimeter of building.

B. All Construction: Nailers shall be the same height as the new lightweight insulating concrete deck or insulation being installed. Nailers shall be anchored to resist a pull-out force of 175 pounds per foot. Fasteners shall be no less than two (2) per nailer and be spaced at two (2) feet on center maximum. Provide nailers at all penetrations. Raise all curbs, flashing, etc, a minimum of ten (10) inches above the deck.

C. Provide additional nailer at all curbs to provide positive drainage away from curb.

3.4 SUBSTRATE PREPARATION

A. Lightweight Insulating Concrete Deck Systems: Nailable fills shall receive base sheet properly fastened with suitable FM approved fasteners and installed in accordance with ASCE 7 wind uplift pressure calculations.

1. Damaged lightweight fill decks shall be removed back to solid material. Fill holes, bird baths, etc., in deck using Zonopatch as manufactured by Siplast; or equal by approved manufacturer.

3.5 APPLICATION OF BASE SHEET

A. Lightweight concrete deck shall be covered with a base sheet, mechanically fastened as follows:

1. Install in accordance with manufacturer's current published application instructions and to meet ASCE-7 wind uplift requirements. Fasteners and fastening patterns shall be determined by building height, pull out values from lightweight insulating concrete decks (more stringent applies), location and geographical area of the United States. It is the installer's responsibility to consult current ASCE-7 publications, literature, and bulletins that are in effect at the time of this project. Submit perimeter, field and corner fastening patterns and cite all ASCE-7 data pertaining to the fastening pattern to the Architect for review.

3.6 ROOF ASSEMBLY INSTALLATION

A. Membrane Application: Install roofing in accordance with roofing system manufacturer's current published instructions and the following requirements. Application of roofing membrane components shall immediately follow application of insulation as a continuous operation.

B. Aesthetic Considerations: An aesthetically pleasing overall appearance of the finished roof application is a standard requirement for this Project. Make necessary preparations, utilize recommended application techniques, apply the specified materials (i.e. granules, metallic powder, etc.) and exercise care in ensuring that the finished application is acceptable to the Owner.

C. Adhesive Application: Apply cold adhesive with a spray equipment or squeegee in a smooth even, continuous layer without breaks or voids at the rate of 1 ½ to 2 gallons per square per ply. (The porosity of some substrates may require a heavier application to ensure full adhesion. Refer to manufacturer’s requirements.)

D. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.

E. Roofing Application:

1. Apply all layers of roofing free of wrinkles, creases or fishmouths. Exert sufficient pressure on the roll during application to ensure prevention of air pockets. Lap seams between the base ply layer and the finish ply layer shall not coincide. Stagger the courses to ensure this.
   a. Apply all layers of roofing perpendicular to the slope of the deck so that water flows over or along lap seams, but never against laps.
   b. Fully bond the base ply to the base sheet or recover board with cold adhesive, torch, hot asphalt or mechanically attached-(Installer’s option). Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps. Each sheet shall be applied directly behind the adhesive installer. Stagger end laps a minimum of three (3) feet.
   c. Fully bond the finish ply to the base ply (Installer’s option). Each sheet shall have a minimum of three (3) inch side and end laps. Each sheet shall be applied directly behind the asphalt installer. Stagger end laps of the finish ply a minimum of three (3) feet. Stagger side laps of the finish ply a minimum of 12 inches from side laps in the underlying base ply. Stagger end laps of the finish ply a minimum of three (3) feet from end laps in the underlying base ply.
   d. Maximum sheet lengths and special fastening of the specified roof membrane system may be required at various slope increments where the roof deck slope exceeds 1/2 inch per foot. The manufacturer shall provide acceptable sheet lengths and the required fastening schedule for all roofing sheet applications to applicable roof slopes. Cold process adhesives shall be used on slopes over 1/2 inch per foot up to and including six (6) inches per foot.
   e. Lap Treatment: A 20-pound roller shall be used on all side and end laps, following immediately behind application, apply uniform pressure across lap area to achieve a continuous visible bleed out. Strictly follow manufacturers guidelines on bleedout.

F. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the finish ply surface, while the bitumen is still hot, to ensure a monolithic color.

3.7 ROOF ASSEMBLY FLASHING INSTALLATION

A. Flashing - General:

1. Flashings shall be installed using the manufacturer's Veral flashing membrane, with length of run not to exceed manufacturer's recommendations.
2. Wooden nailers or curbs shall be installed at all edges and openings in the roof, mechanically fastened to the deck. The nailers should be of exterior grade treated timber, and of the same thickness as any insulation to be used on the roof.
3. Cant strips shall be installed at the intersection of the deck and / or all vertical surfaces. Prime all cants.
4. The roofing field membrane shall extend up over and to the top of cant strips at all vertical intersections or out to the roof's edge.
5. All substrates receiving flashing membrane shall be clean and primed with asphalt primer, prior to application.
6. All flashings shall be mechanically fastened with a termination bar a maximum of six (6) inches on center, be a minimum of eight (8) inches above finished roof height, extend a minimum of nine (9) inches onto the field of horizontal roof membrane, and not exceed ten (10) linear feet of run in length.
7. Install flashing membrane in accordance with drawings and / or material manufacturer's guarantee requirements, whichever is the most stringent.

B. Flashing Application - Masonry Surfaces: Flash masonry parapet walls and curbs using the reinforcing sheet and the metal foil flashing membrane. After the base ply has been applied to the top of the cant, fully adhere the reinforcing sheet, utilizing minimum three (3) inch side laps and extend a minimum of three (3) inches onto the base ply surface and three (3) inches up the parapet wall above the cant. After the final roofing ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or by application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three (3) foot widths (cut off the end of roll) always lapping the factory selvage edge. Stagger the laps of the metal foil flashing layer from lap seams in the reinforcing layer. Extend the flashing sheet a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall / roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers. (See Manufacturer's schematic for visual interpretation.)

C. Flashing Application - Wood Surfaces: Flash wood or plywood parapet walls and curbs using the reinforcing sheet and metal foil flashing membrane. The reinforcing sheet shall have minimum three (3) inch side laps and extend a minimum of three (3) inches onto the base ply surface and to the top of the parapet wall, curb, etc. Nail the reinforcing sheet through the field of the sheet to the vertical wood surface on 12 inch centers from the top of the cant to top of wall curb, etc. Fully adhere the remainder of flashing reinforcing sheet that extends over the cant and roof level. After the finish ply has been applied to the top of the cant, prepare the surface area that is to receive flashing coverage by torch heating granular surfaces or application of asphalt primer; allowing primer to dry thoroughly. Torch apply the metal foil-faced flashing into place using three (3) foot widths (cut off the end of roll) always lapping the factory selvage edge. Extend the flashing sheet a minimum of four (4) inches beyond the toe of the cant onto the prepared surface of the finished roof and up the wall to the desired flashing height. Exert pressure on the flashing sheet during application to ensure complete contact with the wall / roof surfaces, preventing air pockets; this can be accomplished by using a damp sponge or shop rag. Check and seal all loose laps and edges. Nail the top edge of the flashing on nine (9) inch centers. (See manufacturer's schematic for visual interpretation.)

D. Projection Flashings:

1. Plumbing Vents: Soil vent stack pipes shall receive lead flashings installed in accordance with practices set forth in the NRCA Roofing Manual. The lead shall be carried up and over the top of the stack, and crimped down into the pipe to form a watertight seal. Projections shall be flashed as recommended by the roof membrane Manufacturer. Provide tapered edge strips around base. Strip-in flange with specified stripping ply.
2. Square Projections: Strip in all flanges on square projections with specified stripping ply. Prime all flanges prior to setting in a bed of mastic. Install to Manufacturer's specifications. Provide tapered edge strips around base. Cricket up-side slope.
3. Round Projections: Strip in all flanges on round projections with specified stripping ply. Prime all metal prior to setting in mastic. Install to Manufacturer's specifications. Provide tapered edge strips around base.
4. Liquid Flashings: One-Part Liquid Flashing is a one-component polyurethane / bitumen resin that provides a liquid flashing solution for asphaltic roofing systems. Utilize fabric in three part system at all penetrations.

E. Wall and Curb Flashings:

1. The flashing substrate shall be free of all dirt and loose material.
2. ¾” plywood is to be used at all parapets that receive wall flashings.
3. The underlayment ply or plies shall be brought to the top of the cant strip and adhered.
4. Starting on the roof at least six (6) inches from the roofside edge of the cant strip, adhere two (2) plies of flashing extending over the cant and up the vertical a minimum of eight (8) inches. Each lap of the ply sheet shall be a minimum of three (3) inches.
5. Starting two (2) inches past the flashing plies, install one (1) ply of SBS flashing membrane in hot asphalt. Laps shall not coincide with previously installed plies. The top of the SBS flashing shall be one (1) inch past the previously installed plies above the cant strip.
6. Fasten the top edge of the flashings on six (6) inch centers using approved termination bar and fasteners.
7. An NRCA-approved metal counterflashing shall extend down over the flashing a minimum of four (4) inches.
8. Cricket the up-side slope at all curb projections.

F. Use of Metallic Powder: Broadcast metallic powder over all bitumen overruns on the metal foil membrane surface while the bitumen is still hot to ensure a monolithic surface color.

G. Overnight Seal / Water Cut-Off:

1. Over Night Seal: Shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.
2. Water Cut-Off: At the end of day's work or when precipitation is imminent, construct a water cut-off at all open edges. Cut-offs can be built using asphalt or plastic cement and roofing felts, constructed to withstand protracted periods of service. Cut-offs must be completely removed prior to resumption of roofing.

3.8 ROOF SYSTEM INTERFACE WITH RELATED COMPONENTS

A. The following is a list of descriptions for correct installation of components integrated into the roof membrane assembly. In all cases, unless otherwise approved, incorporate flanged components into the system between the application of the base ply and finish ply. The flange must be primed with a uniform coating of approved ASTM D41 asphalt primer and allowed to dry thoroughly; all flanges must be set in approved mastic.

B. Walkway Pads:

1. Provide around all roof hatches, A/C units (if applicable) and at top and bottom of all roof access ladders.
2. Cut the material into maximum five (5) foot lengths and allow to relax until flat.
3. Adhere the sheet using the specified plastic cement. Apply the specified cement in a 3/8 inch thickness to the back of the product in five (5) inch by five (5) inch spots in accordance with the pattern as supplied by the material Manufacturer.
4. Install the walkway pad. Use a minimum spacing of two (2) inches between sheets to allow for proper drainage.
5. Walk-in each sheet after application to ensure proper adhesion.

C. Sealant: Seal all exposed finish ply edges at gravel stops, waste stacks, pitch pans, vent stacks, etc., with a smooth continuous bead of Manufacturer’s approved sealant.

D. Piping / Conduit: Provide hangers and supports as specified in Section 07 72 00, Roof Accessories. Coordinate locations with Architect.

E. Sheet Metal: Refer to Section 07 62 00, Sheet Metal Flashing, Gutters, Downspouts and Trim.

3.9 FIELD QUALITY CONTROL AND INSPECTIONS

A. Roof cuts shall be performed and repaired at installer's expense. Cuts shall be made in the areas as indicated by the Architect's representative. Send required roof cuts to roof membrane Manufacturer for laboratory examination. Roof cuts required by the Architect's representative shall be furnished to the Architect's representative for testing.

B. Remove not more than one (1) 12 inch by 12 inch cut per 5,000 square feet of roof area or fraction thereof.

C. Field audit will follow criteria outlined in current roof membrane Manufacturer's Reference Manual.

D. Repair sampled areas with "feathered in" patch consisting of same number of plies as in the roof specification.

E. Correct deficiencies in roof as prescribed in current roof membrane Manufacturer's Reference Manual and as approved by Architect's Representative.

3.10 CLEANING AND PROTECTION

A. Leave all areas around job site free of trash, debris, roofing materials, equipment, and related items after completion of job.

B. Remove bitumen stains from walls, walkways and driveways.

C. Finished roof areas shall be protected from damage by the installer during construction.

END OF SECTION

SECTION 07 62 00 ROOF RELATED SHEET METAL

PART I – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

A. It is the intent of this Section that the Work shall:
   1. conform to all applicable building code requirements and of authorities having jurisdiction;
   2. include all shop and field formed sheet metal work shown on drawings, specified or required, including, but not limited to:
      a. Roof penetration sleeves and hood and umbrella counterflashing
      b. Metal counterflashing
      c. Expansion joint
      d. Roof drains
      e. Scuppers
      f. Metal perimeter edge
      g. Gutters, Downspouts, Splash Blocks and Splash Pans
      h. One-way roof moisture relief vents
      i. Metal gravity vents
      j. Metal heat exhaust vents
      k. Sanitary vent pipes
      l. Pipe box
      m. Copings, trim and miscellaneous sheet metal accessories.
   3. be part of the Work of the Roofing System; and
   4. be performed by a single source contractor.

1.3 REFERENCES

A. ASTM International (ASTM)
   1. A525, Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process
   2. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
   3. B32, Standard Specification for Solder Metal
   4. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

B. ASCE 7

C. Federal Specifications (FS)
   1. QQ-L-201 for lead

D. National Association of Architectural Metal Manufacturers (NAAMM)

E. National Roofing Contractors Association (NRCA)
   1. Roofing and Waterproofing Manual

F. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
   1. Architectural Sheet Metal Manual

G. ANSI / SPRI ES-1

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.

B. Shop Drawings: Indicating sizes, configurations, details of attachment to related and adjacent work, materials, and finishes.

C. Samples:
   1) Full range of finish colors for Architect's selection.
   2) 12-inch-long sample of each specified item with approved finish.
   3) Provide full size mockup of all shop-built assemblies.
   4) Documentation of Wind uplift requirements for Roof Edge for specific project location
      a. Wind Calculator available online

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Fabricator and installer of roof-related flashing, installer of prefabricated edge metal and accessories shall be the same as the membrane roof installer.

B. Comply with governing codes and regulations of authorities having jurisdiction.

C. ANSI / SPRI ES-1: Install sheet metal edge flashings and copings to comply with requirements of ANSI / SPRI ES-1 / FM 1-49 for minimum of up to 115 MPH wind speed zone and wind resistance loads.

1.6 INSTALLATION CONFERENCE

A. Refer to Section 01 31 13, Project Coordination.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store materials in accordance with manufacturer's instructions.

B. Handle and store materials and equipment in such a manner as to avoid damage.

C. No storage of materials shall be permitted on roof areas other than those materials that are to be installed the same day. Any exception must be in written form. Do not place materials or equipment in such a manner as to overload structure.

1.8 WARRANTIES

A. Manufacturer's Product Warranty:
   1) Manufacturer's standard 30-year Kynar 500 or Hylar 5000 Finish warranty signed by the manufacturer, with guarantee covering any failure of the fluoropolymer finish during the warranty period.
   2) Failure is defined to include, but not be limited to:
      a. Deterioration of finish, such as fading, discoloring, peeling, cracking, corroding, etc.
   3) Wind Warranty
      a. Up to 55 MPH Blow Off Resistance, 20 Year tied into Manufacturers Roofing Warranty.

4) Correction may include repair or replacement of failed product as outlined in Warranty Documents
5) Finish warranty and wind warranty shall be delivered by Roofing Contractor to Owner at the conclusion of project as part of project closeout documents.

B. Roofing Contractor's Warranty:
1. Contractor shall warrant the installation and related work to be free from defects in workmanship and materials, and that the metal flashings will be and remain watertight and secure, for a period of five (5) years from date of Substantial Completion.
2. Defects shall include, but not be limited to:
a. Leaking water on the exterior of the building, causing staining or discoloration of wall / exterior surface.
b. Leaking water or bitumen within building or construction.
c. Becoming loose from substrate / blocking.
d. Loose or missing parts.
e. Finish failure as defined above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Elevate

B. Substitutions: Presented by contractor before proposal date upon architects approval.

C. Requests for substitutions will be considered in accordance with provisions of Div. 1

D. Manufacturers named within specification are approved for use on the Project providing:
1. their products meet or exceed the specifications;
2. company has a minimum of five (5) years' experience manufacturing products of the type specified;
3. products have been tested in conjunction with roofing membrane system as an assembly and as such has obtained the same approval and rating as the roofing membrane system; and
4. products are approved for use by the roofing membrane manufacturer.

2.2 SHEET METAL MATERIALS

A. General Requirements: Roofing sheet metal system shall have been tested in conjunction with roofing membrane system as an assembly and have the same approval and rating as the roofing membrane system.

B. Prefinished Aluminum Sheet:
1. Precoated type, aluminum conforming to Fed. Spec. QQ-A-250, ASTM B209.
2. Finish: Kynar 500, color as selected by Architect from manufacturer's full range of colors.
3. Thickness: Minimum -0.040 to 0.050, except as otherwise indicated. See below for specific items.

C. Sheet Lead:
1. Comply with FS QQ-L-201, Grade B
a. Four (4) pound minimum for use at roof drains.

D. Stainless Steel: ASTM A167, Type 302 / 304 Soft Temper, No. 2D finish. Minimum thickness 24 gauge, except as otherwise noted.

2.3 FASTENERS

A. Same metal as flashing / sheet metal or other non-corrosive metal or as noted below.

B. Exposed fasteners shall be self-sealing and gasketed (ZAC type) for weathertight installation.

C. Match finish of exposed heads with material being fastened.

D. Mechanical Fasteners:
1. Nails: Ring shank, minimum 1-1/2 inches in length with 1/2-inch diameter head.
2. Washers: Steel washers with bonded rubber sealing gasket.
3. Screws: Self-tapping sheet metal type of stainless steel or compatible with material being fastened, with hooded integral EPDM washers (ZAC type).
4. Rivets: Stainless steel and cadmium plated material, closed end type of sizes recommended by sheet metal manufacturer to suit application.

E. Clips:
1. Cleat (coping / fascia): Minimum 22-gauge, G-90 galvanized, stainless steel. Match material of coping / fascia and provide one (1) gauge heavier.

2.4 RELATED MATERIALS

A. Solder: ASTM B32, alloy grade 58, 50 percent tin, 50 percent lead.

B. Flux:
1. Phosphoric acid type, manufacturer's standard.
   a. For Use with Steel or Copper: Rosin flux
   b. For Use with Stainless Steel: Acid-chloride type flux, except use rosin flux over tinned surfaces.

C. Underlayment:
1. At expansion joints: to be used as bellow; 48 mil minimum, non-reinforced, homogeneous, waterproof, impermeable elastomeric sheeting manufactured by Nervastral, Inc. or Lexsuco.
2. At wood blockings: Self-Adhered Flexible Flashing: 40-mil, rubberized asphalt adhesive reinforced flashing with a high density cross laminated polyethylene film. Provide compatible substrate primer as instructed by manufacturer and coordinate with specification 07 65 00.

D. Adhesives: Type recommended by flashing sheet manufacturer seaming and adhesive application of flashing sheet to ensure adhesion and watertightness.

E. Metal Accessories: Sheet metal clips, straps, anchoring devices, clamps and similar accessories required for the complete installation of work, matching or compatible with material being installed, non-corrosive, size and gauge recommended by installer to suit application and performance.

F. Sealant:
1. Type A:
   a. Type: One-part, non-sag, moisture-curing polyurethane sealant.

b. Approved Products / Manufacturers: “Chem-Calk 900” manufactured by Bostik Construction Products Division, “Vulkem 921” manufactured by Mameco International, Inc., “Dynatrol I” manufactured by Pecora Corporation, “MasterSeal NP 1” manufactured by BASF, or approved equal.

2. Type B:
   a. Type: One-part, neutral-curing, medium-modulus silicone sealant for sealing metal to metal surfaces, i.e. metal edge, cover plates, etc.
   b. Approved Products / Manufacturers: “Chem-Calk 1200” manufactured by Bostik Construction Products Division, ”795 Silicone Building Sealant” manufactured by Dow Corning Corporation, “895 Silicone” manufactured by Pecora Corporation, “Omniseal” manufactured by Sonneborn Building Products, “Spectrem 2” manufactured by Tremco Incorporated, or approved equal.

G. Termination Bar:
1. Material: Stainless steel or extruded aluminum bar with lipped profile.
2. Size: 1/8 inch thick by one (1) inch wide with factory punched 1/4-inch x 3/8 inch oval holes spaced six (6) inches on center.
3. Product: Provide manufacturer approved termination bar

H. Pipe Hangers and Supports: Refer to Section 07 72 00, Roof Accessories.

I. Splash Blocks: Concrete type, of size and profiles indicated; minimum 3,000 psi compressive strength at 28 days, with minimum five (5) percent air entrainment. Use at locations where roof drainage discharges on ground.

2.5 FABRICATION

A. Except as otherwise indicated, fabricate work in accordance with SMACNA Architectural Sheet Metal Manual and other recognized industry practices and reviewed shop drawings. Form all flashings, receivers and counterflashings in accordance with standards set forth in the NRCA roofing manual and SMACNA.

B. Comply with manufacturer's installation instructions and recommendations.

C. Shop fabricate Thru-wall, counterflashings, expansion joint metal and wind clips to greatest extent possible.

D. Fabricate items to size and dimensions as indicated on the drawings. Limit single-piece lengths to twelve (12) feet for prefabricated pieces and ten (10) feet for shop fabricated pieces.

E. Face of any fabricated vertical metal fascia or coping shall not exceed 8” without stiffener band or birds beak. If stiffener band or birds beak cannot be fabricate, contractor to use multiple pieces of metal to achieve overall distance without going over the 8” maximum per piece.

F. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work sufficient to permanently prevent leakage, damage or deterioration of the work.

G. Integrate flashing in a manner consistent with membrane waterproofing detailing. Form work to fit substrates.

H. Make angle bends and folds for interlocking metal with full regard for expansion and contraction to avoid buckling or fullness in metal after installation.

I. Fabricated items will have straight lines, sharp angles, smooth curves, and true levels. Avoid tool marks, buckling, and oil canning.

J. Fold back edges on concealed side of exposed edge to form hem.

K. Unless noted otherwise, lap joints minimum three (3) inch. Lap joints to have sealant installed as per details, to maintain watertight condition, inside and outside corners and elevation changes to be riveted and soldered.

L. Seams:
1. Wherever possible, fabricate non-moving seams in sheet metal with flat-lock seams and end joints.
2. Pre-finished Galvanized Steel: Seal pre-finished metal seams with rivets and silicone sealant.
3. Metal Other than Aluminum: Tin edges to be seamed, form seams, and solder.

M. On Kynar 500 or Hylar 5000 pre-finished metal, surface sand metal flanges prior to applying any primers. Prime all metal in contact with bituminous material.

N. Backpaint all concealed metal surfaces with bituminous paint where expected to be in contact with cementitious materials or dissimilar metals.

O. Expansion Provisions: Where lapped or bayonet type expansion provisions in work cannot be used or would not be sufficiently waterproof or weatherproof, form expansion joints of intermeshing hooked flanges, not less than one (1) inch deep filled with mastic sealant concealed within joints.

2.6 FABRICATED ITEMS

A. Metal Flashings:
1. Through Wall Receiver Tray: Minimum 24-gauge stainless steel formed in maximum ten (10) foot lengths, through wall receivers shall not extend past the face of the exterior veneer more than ¾".
2. Counterflashings: Minimum .040 prefinished aluminum, formed in maximum ten (10) foot lengths.

B. Wind Clips: Minimum (material of counterflashing), one (1) inch wide by length to engage counterflashing a minimum of 1/2 inch. To be installed at all wall flashings and at curb flashing lengths longer than 5 feet.

C. Roof Penetrations:
1. Umbrella Counterflashing: Two-piece construction of minimum 22-gauge stainless steel, fabricated in accordance with drawings or project requirements.
2. Flashing Pans:
   a. 24-gauge stainless steel.
   b. Fabricate to provide installed minimum clear inside perimeter dimension of two (2) inches on each side of penetrating element.
   c. Fabricate pans to at least six (6) inches above the finished roof membrane and with 1/4-inch hem at top edge and with four (4) inch flanges. Round all corners of flange.
   d. Fabricate metal bonnets for all pans, NO EXCEPTIONS. Fabricate bonnets with metal compatible with metal to which bonnet is to be

attached. On beams and other steel, weld in place bonnets fabricated from 1/4-inch steel plate. Draw band bonnets fabricated from 22-gauge stainless steel may be used on circular projections.

D. Metal Edge / Fascia:

1. UNA-Edge Gravel Stop for Modified Bitumen Roof Systems.
   1) Metal:
      a) .050 prefinished aluminum.
   2) Finish:
      a) Kynar-500 color as selected by the Architect from roof edge manufacturer's full range of colors.
   3) Fascia: Standard 12 feet 0 inches lengths with matching concealed joint splice plates.
   4) Splice Plates and 22 gauge galvanized continuous cleats with slotted holes are included.

2. UNA-Edge Drip Edge for Modified Bitumen Roof Systems.
   1) Metal:
      a) .050 prefinished aluminum.
   2) Finish:
      a) Kynar-500 color as selected by the Architect from roof edge manufacturer's full range of colors.
   3) Fascia: Standard 12 feet 0 inches lengths with matching concealed joint splice plates.
   4) Splice Plates and 22 gauge galvanized continuous cleats with slotted holes are included.

E. Metal Coping
1. Elevate Coping Tapered Version
   1) Construction:
      a) Metal:
      b) .050 prefinished aluminum.
      a) Finish:
         1) Kynar-500 color as selected by the Architect from roof edge manufacturer's full range of colors.
   2) Coping Cap: Length of 12'-0", widths to 24" manufactured to job requirements. True radii may be built to template.
   3) Coping Vertical Face and Back Leg: 2 ¼" to 12 ½" manufactured to job requirements.
   4) Concealed Splice Plates: 8" wide. Finish to match finish of coping cap with factory applied dual non-curing sealant strips.
   5) Anchor / Support Cleat: 20-gauge pre-punched galvanized cleat with stainless steel spring mechanically locked to cleat normally 12" wide at 4'-0" on center. Mechanically fastened as indicated and detailed.
   6) Fasteners: 1 ½" stainless steel with driver.

F. Continuous Cleats (where applicable): Continuous strips, same material and profile, minimum one gauge heavier of item which cleats attach.

G. Vent Hoods, Sleeves, Penetration Flashings, and Accessories: Minimum 24-gauge stainless steel, or as shown or directed otherwise.

H. Angle Termination Bar: Aluminum pressure bar 1/8-inch x one (1) inch.

I. Downspouts / Collector Heads: System by same manufacturer.
1. Minimum 0.050 Prefinished Aluminum, formed in maximum twelve (12) foot lengths.
2. Verify Scupper and downspout meets rainfall data as outlined in SMACNA.
3. For Modified Bitumen Systems: Include UNA-Edge Drip Edge without Continuous Cleat.
4. 24-gauge galvanized steel, color to match collector head.
5. End Caps, Downspout Outlets and Downspout Straps, Support Brackets and joint fasteners to be manufactured to suit profile and dimension of gutter and downspout.
6. Install all anchoring devices as outlined in manufacturer literature.
7. Downspout straps: Strap type, like metal, match color.
8. Collector Heads: Minimum 0.050-inch thick pre-finished (match color) aluminum. As outlined in SMACNA; Refer to Figure 1-25F and Figure 1-28 with alternate Section A-A.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrates are smooth and clean to extent required to perform sheet metal work.

B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set in place.

C. Verify that reglets, nailers, cants, and blocking to receive sheet metal are in place and free of concrete and soil.

D. Do not start work until conditions are satisfactory.

3.2 PREPARATION

A. Field measure site conditions prior to fabrication work.

B. Install starter and edge strips and cleats before starting installation.

3.3 INSTALLATION

A. Install sheet metal with lines, arises, and angles sharp and true, and plane surfaces free from objectionable wave, warp, or buckle. Exposed edges of sheet metal shall be folded back to form 1/4-inch hem on concealed side from view. Finished work shall be free from water retention and leakage under all weather conditions. Pre-fabricated corners or transitions are required at changes in direction, elevation, or plane and at intersections. Locate field joints not less than 12 inches, nor more than three (3) feet from actual corner. Laps shall be one (1) inch, riveted and soldered at following locations:
1. Pre-fabricated corners;
2. transitions;
3. changes in direction, elevation, and plane; and
4. at intersections.

B. Anchor units of work securely in place to prevent damage or distortion from wind or buckling. Provide for thermal expansion of metal units; conceal fasteners wherever possible; and set units true to line and level as indicated. Install work with laps, joints, and seams which are permanently watertight and weatherproof.

C. Install fabricated sheet metal items in accordance with manufacturer's installation instructions and recommendations and with SMACNA Architectural Sheet Metal Manual.
1. Ensure approved fasteners are used throughout the project.

2. Ensure fasteners are installed in manufacturer pre-punched holes on rails, extrusions, clips and cleats.

D. Separations: Provide for separation of metal from dissimilar metal or corrosive substrates by coating concealed surfaces with zinc chromate, bituminous coating, or other permanent separation at locations of contact as recommended by manufacturer or fabricator. Do not use materials which are incompatible with roofing system.

E. Cleat: At exposed edges of perimeter edge, fascias, cap flashings, and where required, attach cleat with appropriate fasteners supplied by roof edge manufacturer. Install cleat so fascia extends a minimum of 1 inch below top of exterior wall finish.

F. Counterflashing:
1. Do not use surface mount counterflashing except as noted in drawings.
2. Set in through wall with receiver and spring lock counterflashing, as detailed in drawings and to NRCA roofing manual, SMACNA standards.
3. Coordinate installation of through-wall flashing with the masonry contractor.
4. Seal through-wall in conjunction with masonry wall waterproofing.
5. Install wind clips 30 inches o.c. at all counterflashing over five (5) feet in length.

G. Scupper/Collector / Downspouts:
1. Install as detailed.
2. Install downspouts plumb and level, attached to columns or wall with straps located at top and bottom of downspout and maximum ten (3) feet on center (note: 3 per 12' lengths supplied by manufacturer.
3. Install splash pad or block under discharge port of downspouts (if non exist). Install splash pan over a protection (walkway) pad for downspouts located at roof level.

3.4 CLEANING AND PROTECTION

A. Remove flux and residual acid immediately by neutralizing with baking soda and washing with clean water. Leave work clean of stains.

B. Remove scraps and debris and leave work area clean.

C. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes. Paint areas where finish is damaged on pre-finished metal by painting with a compatible paint in color to match undamaged finish.

D. Prime soldered area of phosphatized metal after cleaning to prevent rusting.

E. Paint metal flashings that have been soiled with bitumen with aluminized paint.

F. Clean other work damaged or soiled by Work of this Section.

G. Protect finished work from damage.

END OF SECTION

SECTION 07 65 00 FLEXIBLE FLASHING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

B. Provide flexible flashing where shown on drawings or required.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.

B. Certification: Manufacturer's affidavit that materials used in Project contain no asbestos.

C. Compatibility: Submit letter from primary Fluid Applied Air Barrier System Manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use. Submit letter from Manufacturer stating that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

A. Manufacturers listed whose products meet or exceed the specifications are approved for use on the Project. Flexible flashing materials used shall be compatible with and not void any warranties of the air barrier system used. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 MATERIALS

A. Flashing:
   1. Copper Laminated Flashing (Contractor's Option – in lieu of asphalt-free copper fabric flashing):
      a. Flashing: A full sheet of copper weighing five (5) ounces per square foot coated or bonded on both sides with one (1) of the following:
         1) Modified asphalt compound coated.
         2) Asphalt saturated, waterproof glass fiber laminated fabric.
      b. Approved Manufacturers:
         1) Advanced Building Products, Inc.
         2) Hohmann & Barnard, Inc.
         3) Sandell Manufacturing Company, Inc.
         4) York Manufacturing, Inc.
      c. Mastic: Manufacturer recommended asphalt troweled mastic for sealing copper laminated flashings

2. Asphalt-free Copper Fabric Flashing (Contractor's Option – in lieu of copper laminated flashing):
   a. Glass fabric scrim bonded to a full sheet of copper for general thru-wall flashing as an alternative to asphalt coated copper specified above and where sealant compatibility is required. Provide manufacturers approved seam tape.
   b. Approved Product/Manufacturer: Multi-flash 500 as manufactured by York Manufacturing, Inc.; or Copper-Tuff as manufactured by Hohmann & Barnard, Inc. (No substitutions)

3. Membrane Flashing:
   a. Self-Adhered Flexible Flashing: 40-mil, rubberized asphalt adhesive reinforced flashing with a high density cross laminated polyethylene film. Provide compatible substrate primer as instructed by manufacturer.
   b. Approved Products / Manufacturers:
      1) "TW-Thru Wall Flashing" manufactured by Tamko Waterproofing.
      2) "Perm-A-Barrier" manufactured by W. R. Grace & Co.
      3) "Blueskin TWF" manufactured by Henry Co.
      4) "Air-Shield Through wall flashing" manufactured by W.R. Meadows, Inc.
      5) "AquaFlash 500" manufactured by Fiberweb.
4. Substrate Primer: as instructed by membrane manufacturer
5. Termination Bar: 1/8 inch thick by 1 inch minimum wide stainless steel, w/ pre-punched holes and self-tapping screws.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Flashing:
1. Follow manufacturer's instructions for mechanically fastened installation with a termination bar.
2. Application Guidelines - Install flashing at the following locations:
   a. Membrane Flashing: material transitions inside exterior cavity walls, roof edge / exterior wall transitions, masonry joints (control/expansion) inside exterior cavity walls, exterior door and window frame perimeters, roof deck / exterior wall transitions, exterior wall penetrations (i.e. pipe, conduit, ducts, etc.). Provide membrane at all joints, holes, gaps, or openings to ensure a continuously sealed building envelope. Utilize primer on substrates as instructed by manufacturer.
   b. Copper Flashing: At all horizontal wall flashing, including (but not limited to) exterior wall sill / weep conditions, exterior door and window head / weep conditions, intermediate and / or shelf angles, masonry wall cap flashing and masonry wall base flashing.
3. Apply substrate primer as instructed by membrane manufacturer to suit condition.
4. Provide drip edge flashing at weep conditions with membrane flashing. Cut ¼" to ½" behind with outside edge of brick over top of drip edge flashing to alleviate exposure to UV degradation and deterioration of asphalt membrane.

5. On Horizontal Surfaces: The flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. The flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches. Flashing will then be secured in back wall with termination bar.
6. On Vertical Surfaces: Surfaces receiving the flashing shall be sufficiently spotted with asphalt mastic to hold in place until masonry is set. Secure in back wall with termination bar.
7. Foundation Sill Dampproofing: The flashing for foundation sills shall be laid in a slurry of fresh mortar or in a full bed of mastic and topped with a fresh full bed of mortar. The flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be sloped across the cavity and turned up the wall a minimum of ten (10) inches and secured to back wall with termination bar. Where sill and column meet, flashing shall be brought up a minimum of ten (10) inches up the column.
8. Thru-Wall Flashing: Shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Carry flashing through the wall, turned up where possible to facilitate drainage through the weepholes, then carried upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secure in back wall with termination bar.
9. Lintel: Premolded or field molded end dams must be provided at each end of all lintels.
10. Cavity Wall: Flashing shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise, and secured in the back wall with termination bar. Vertical membrane joints shall be secured with termination bar as instructed by membrane manufacturer.
11. Heads, Jambs and Sills: Flashing for heads and sills shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Flashing shall be carried through the wall and upward across the cavity a minimum of six (6) inches, unless noted otherwise. Head flashing shall be carried six (6) inches beyond both end of the steel lintel. Both head and sill flashing shall be turned up at the sides to form a pan. All corners shall be folded, NOT CUT. Jambs are to be turned into the buildings to complete seal perimeter of window or door. Install weepholes.
12. Windows: wrap all heads, sills and jambs into opening with flexible flashings.
13. Wood blockings: Flexible flashings are to cover wood blockings in their entirety.
14. Spandrels: Spandrel flashing shall start from the outside toe of the shelf angle, go up the face of the beam and then through the wall, turned up on the inside not less than two (2) inches. Install weepholes.
15. Parapet or Coping: Flashing for parapets or coping sills shall be laid in a slurry of fresh mortar and topped with a fresh full bed of mortar. Flashing shall be cut ¼" to ½" behind the exterior face of the wall after being left exposed for inspection purposes only. Weepholes shall be installed immediately on top of the flashing.
16. Lengths: Install flashings without longitudinal joints within walls, if possible. If required materials are not available in a single width, join by lapping material minimum two (2) inches and seal joint throughout its length with adhesive.
17. End Joints: Avoid end joints in flashing. When end joints are necessary, lap flashing minimum six (6) inches and seal joint continuously with adhesive.
18. Penetrations: Where anchors, pipes, and inserts penetrate flashing, make opening in flashing snug and seal with adhesive.

19. Reglet Termination: Insert wedge into place and seal carefully with adhesive.
20. Termination Bar: Install flashing with termination bars in accordance with manufacturer's instructions. Provide 3 coursing at all termination bars, typical.
21. Top Coat: After flashing material is in place (except in masonry joints where bond and mortar is required) trowel full 1/8 inch protective coating or mastic on all flashing faces.
22. Lintels: Provide pre-molded end damns at all lintel ends.

B. Bed Joints: Coordinate work with Division 4, Masonry. Install thru-wall flashings between two (2) thin layers of masonry mortar without increasing thickness of mortar joint. Keep outer edge of flashing material back 3/4 inch from face of masonry.

3.2 APPLICATION

A. Protect membrane from overexposure to direct sunlight.

B. Follow manufacturer’s recommendations for installation.

C. Adjacent Work: Protect work by masking, covering, or other precautionary methods. Remove protection when no longer necessary.

END OF SECTION

SECTION 07 65 26 MEMBRANE THROUGH-WALL FLASHING

PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install all thru-wall flashing at all exterior walls to create a complete watertight exterior wall system.

B. Through-wall flashing and accessories for installation in cavity wall construction in the following locations:

1. Wall bases
2. Window sills
3. Heads of openings
4. Shelf angles / lintel angles
5. Tops of walls
6. Parapets
7. Above wall projections such as windows or canopies
8. At other discontinuities in the cavity

1.02 MISCELLANEOUS REQUIREMENTS

A. Installer: The installer of the flashing specified in this section shall be the installer of the associated materials for undivided responsibility.

B. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

1.03 REFERENCES

A. ASTM D 146 Standard Test Methods for Sampling and Testing Bitumen Saturated Felts and Woven Fabrics for Roofing and Waterproofing

B. ASTM D 412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers Tension

C. ASTM D 570 Standard Test Method for Water Absorption of Plastics

D. ASTM D 903 Standard Test Method for Peel and Stripping Strength of Adhesive Bonds

E. ASTM D 1876 Standard Test Method for Peel Resistance of Adhesive

F. ASTM D 4263 Standard Test Method for Indicating Moisture Content by Plastic sheet Method

G. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials.

H. ASTM E 154 Standard Test Methods for Water Vapor Retarders used in Contact with Earth under Concrete Slabs, on Walls or as Ground Cover

1.04 SUBMITTALS

A. Provide submittals in accordance with Section 01 30 01

B. Shop drawings showing locations of through-wall flashing and details of all typical conditions.

C. Manufacturer's technical data sheets and material safety data sheets for Product and Accessories.

D. Manufacturer's installation instructions.

E. Manufacturers documentation of volatile organic compounds (VOC) content for Product and Accessories.

F. Certification of compatibility by Manufacturer, listing all materials on the Project with which the Product and Accessories may come into contact.

G. Samples of Product minimum 3 inch by 4 inch size.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Installer shall be experienced in applying the same or similar materials and shall be specifically approved in writing by Manufacturer.

B. Single Source Responsibility: Obtain Product and Accessories from single manufacturer.

C. Product and Accessories shall comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

D. Cooperate and coordinate with the Owner's inspection and testing agency. Do not cover any installed Product unless it has been inspected, tested and approved.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, lot number and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by Manufacturer.

C. Protect stored materials from direct sunlight. Do not store cylinders of Aerosol Contact Adhesive above 110 degrees F.

D. Avoid spillage. Immediately notify Architect if spillage occurs and start clean up procedures. Clean spills and leave area as it was prior to spill.

1.07 WASTE MANAGEMENT AND DISPOSAL

A. Separate and recycle waste materials in accordance with Construction Waste Management and Disposal, and with the Waste Reduction Work Plan.

B. Place materials defined as hazardous or toxic waste in designated containers.

C. Ensure emptied containers are stored safely for disposal away from children.

1.08 PROJECT CONDITIONS

A. Do not apply during rain or accumulating snowfall.

B. Apply at ambient temperatures above 40 degrees F unless procedure for low temperature application is followed. Do not apply during rain.

C. Low Temperature Application: Use Low-Temp Product. Store in heated area until use. Apply at ambient temperatures above 25 degrees F.

D. Contact Adhesives: Maintain cylinders of Aerosol Spray Contact Adhesive above 60 degrees F during spray. Do not apply Water-Based Contact Adhesive at ambient temperatures below 40 degrees F.

1.09 WARRANTIES: Provide the Manufacturers minimum five year material warranty under provisions of Warranties Section.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS / PRODUCTS

A. W.R. Grace Const. Products - “Perm-A-Barrier” 40 mil wall flashing
B. W.R. Meadows - “Air Shield” - 40 mil
C. MFM Building Products. - “MFM Subseal - 40”
D. Tamko Building Products - “Tamko TW Flash-N-Wrap - 40”
E. Polyguard Products, Inc. - “Polyguard 400”
F. Carlisle Coatings & Waterproofing - CCW-705-TWF, 40 mil thru wall flashing
G. Henry Co. - “Blueskin TWF” - 40 mil
H. Fortifiber Building System - “FortiFlash 40 mil”
I. Sandell Construction Solutions - Sando-Seal 40 mil”
J. Hyload 40 mil flashing and flashing systems

K. Substitution products shall conform to requirements of membrane flashing listed below.

2.02. MEMBRANE FLASHING

A. Elastic Sheet Flashing/Membrane: Composite, self-adhering, rubberized asphalt membrane laminated to a high density polyethylene film consisting of minimum 40 mils thickness and complying with the following:

Thickness: min. 40 mil
Tensil Strength (ASTM D412): not less than 900 psi
Ultimate elongation (ASTM D412): 200%.
Low temperature flexibility (ASTM D 746): -30°F
Pliability (ASTM D146): pass @ -25° F, ¼” mandrel
Peel Adhesion (ASTM D-903): 5 lbs./in. min.
Puncture Resistance (ASTM E-154): 40 lbs. min.
Resistance to ozone aging (ASTM D 1149): no cracks for 10% elongated sample for 100 hours in 50 pphm (50.5 mPa) ozone at 104°F.
Resistance to Heat Aging (ASTM D573): Maximum hardness increase of 15 points, elongation reduction of 40%, and tensile strength reduction of 30% or 70 hours at 212°F.

2.03 MISCELLANEOUS MATERIALS

A. Adhesives: Type recommended by flashing sheet manufacturer for waterproof/weather-resistant seaming and adhesive application of flashing sheet. Verify compatibility of adhesive with manufacturer of material for which flashing/adhesive is being applied to.

B. Primer, Mastic, Fill Compound: Type recommended by flashing sheet manufacturer and compatible with substrate.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions affecting installation of the through-wall flashing and accessory products for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing Work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Concrete shall be cured for a minimum of seven days.

C. Surfaces shall be sound, dry and free of oil, grease, dirt, excess mortar or other contaminants.

D. Surfaces shall be supported and flush at joints without large voids or sharp protrusions.

E. Inform Architect in writing of anticipated problems applying Product over substrate.

3.02 SURFACE PREPARATION

A. Fill joints and cracks greater than 1/4 inch width with Fill Compound struck flush.

B. Fill inside corners and angle changes with minimum 1/2 inch tooled bead of Fill Compound.

3.03 INSTALLATION OF MEMBRANE FLASHING

A. Allow Fill compound used to cure fully before applying Product.

B. Apply Product to sound substrate. Do not apply over mechanically-attached water resistive barrier such as felt, paper or house wrap.

C. Apply Contact Adhesive to substrate. Apply thin, continuous coating at coverage rate indicated on technical data sheet. Allow to dry until it does not transfer when touched, but still has tack. Re-apply to surfaces that have become dusty or lost tack.

D. Apply Product over surface the same day of application of Contact Adhesive.

E. Cut manageable length pieces of Product from roll. Position, remove release liner and press to substrate with hand pressure. Avoid trapping air and forming wrinkles

F. Lap adjacent pieces 6 inches minimum. Wipe film surface with clean towel to assure good adhesion of laps.

G. Cut and fit around penetrations such as imbedded masonry ties.

H. Cut and fit to cover inside and outside corners

I. Turn up ends at discontinuities 1 inch minimum to form end dams.

J. Roll firmly to substrate with hand roller tool. Roll laps firmly in perpendicular direction to terminating edge.

K. Seal end laps, cut edges and around penetrations with Mastic.

L. Product shall extend vertically up the back-up wall 8 inches minimum.

M. Keep Product minimum 1/2 inch from finished exterior. Keep edge from contacting visible sealant.

N. Terminate Product onto metal drip edge protruding to exterior.

O. Anchor and seal vertical termination on back-up wall with one of the following methods:
1. Secure with Termination Bar fastened to substrate. Seal Termination Bar to substrate with Mastic.
2. Build into unit masonry back-up wall. Product shall extend into wall 2 inches minimum

P. General: Through-wall, flexible membrane flashing shall be installed at heights, conditions, locations as drawings indicate to manufacturer's current recommendations and as called out in this section.

Q. Protect the material from tears and punctures during operations. Apply material to clean, ice free, dry substrate. Do not apply primer or membrane to frozen substrates.

R. Do not install membrane at temperatures below 40°F.

S. Do not apply primer or membrane to damp or contaminated surfaces.

T. Remove foreign matter, rubbish, debris. Fill holes, joints, cracks and point flush with projections. Do not leave flashing in place unprotected from ultraviolet deterioration for more than two days. In cold weather, store adhesives at 70° for 24 hours before use. Flashing not to be penetrated except as shown for nailing. Flashing to be turned down minimum 2" on roof side of curb and extend down to within 1/2" of bottom of sheet metal or to cover the existing flexible flashing by 2", as the case may be. Use adhesives at attachment points and laps. Install turned up (end dams) at all masonry sills and lintels minimum 2" and extend to within 1/2" of exterior wall. No shapes to be constructed that would trap water. Flashing to have waterproofing integrity and shaped so as to shed water to exterior wall weep holes. At re-entry wall conditions, special attention shall be given to provide continuous coverage without gaps to deliver water from wall cavity to exterior face of finish wall.

U. Bonding Flashing to Building Elements: Apply primer for self-adhering membrane as recommended by manufacturer or brush adhesive on building elements used as substrates for non-self-adhering flashing. Allow to become tacky, then apply and press the membrane into adhesive; laps to be minimum 6".

V. Bonding Flashing to Flashing: Lap flashing minimum 6". Apply a continuous coat of adhesive to both surfaces of flashing. Allow adhesive to air dry until it no longer transfers to the finger when touched. Work flashing from one edge of the joint to the other and press flashing firmly together. Avoid air entrapment or excessive use of adhesive.

W. Location: Provide through-wall flashings at all locations necessary to provide waterproofing integrity. This includes window penetrations.

X. Masonry Mount Reglet: Shall be installed prior to through-wall flashing. Set into a thin layer of fresh mortar followed by through-wall flashing. Follow corner and other drawings as shown and as recommended by Fry. Masonry mount reglet not to bridge expansion joint, control joint. Provide cover part at these locations.

Y. Weep Holes: Provide ventilators-weep holes 24” o.c. immediately above through-wall flashing on exterior walls.

END OF SECTION 07 65 26

SECTION 07 72 00 ROOF ACCESSORIES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 INSTALLATION RESPONSIBILITY

A. In addition to the items normally a part of this Section, coordinate the installation of roof accessory curbs and pipe flashings and equipment supports that may be specified elsewhere.

B. Coordinate the Work specified herein with the following Work:
   1. Roofing
   2. Roofing sheet metal
   3. Mechanical equipment
   4. Plumbing

1.3 REFERENCES

A. Federal Specifications (FS)
   1. TT-S-00227E

B. National Roofing Contractors Association (NRCA)

C. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA)
   1. Architectural Sheet Metal Manual

1.4 SUBMITTALS

A. Product Data: Submit schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Shop Drawings: Indicate size, material, and finish. Show locations and installation procedures. Include details of joints, attachments, and clearances.

1.5 PRE-INSTALLATION CONFERENCE

A. Refer to Section 01 31 13 – Project Coordination.

1.6 WARRANTY

A. Warranty the Work specified herein for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
   1. Noticeable deterioration of finish
   2. Leakage of water into the building or within the construction.

C. Rooftop supports – 5-year limited warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on products of named manufacturers. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 PREFABRICATED ROOF CURBS

A. Frames:
   1. Material: ASTM A 653 G90 hot-dipped galvanized steel.
      a. Minimum 18 gauge, and as engineered by manufacturer.
      b. Minimum 18 gauge for curbs supporting HVAC units.
      c. Minimum 20 gauge for expansion joint curbs.
   2. Corners: Mitered and welded (welds are micro sealed and prime painted after fabrication). Bolted connections not accepted.
   3. Base Plates: Integral to frame and welded.
   4. Internally reinforced with galvanized 1 inch by 1 inch by 12-gauge angles for curbs exceeding 3-foot length. Reinforce internal bulkhead at equipment curbs to support lateral loads.
   5. Wood Nailers: Factory installed, pressure treated. Size and width as suitable for support of items installed on curbs.

B. Insulation: Factory installed 1-1/2 inch thick three-pound density fiberglass insulation.

C. Curb Height: Minimum 8 inch above finished roof.

D. Construct curbs to match roof slope with plumb and level top surface for mounting mechanical equipment.

E. Gasketing: 1/4 inch thick, one (1) inch wide at roof top units.

F. Counterflashing: 24-gauge stainless steel

G. Counterflashing Cap: Stainless steel.

H. Cants:
   1. Non-canted curb style installs either under or on top of metal decks with insulation.
   2. Cants shall be provided under Section 07 52 19 - Roofing

I. All insulated roof curbs shall be structural and shall include calculations signed and sealed by a registered Structural Engineer. Refer to installation drawings for any additional structural requirements. If curbs do not span a minimum of two bar joists, only two angles will be required. Coordination mechanical equipment weight loading on the roof with Structural Engineer.

J. Approved Manufacturers:
   1. Custom Curb, Inc.
   2. Roof Products, Inc.

2.3 PIPE SUPPORTS (Cannot be contractor built supports)

A. Gas Pipe Supports:
1. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (10 inches x 16 inches x 3 inches; 6 lbs. each); Model Type PP-10 with strut & hanger for lines 2-1/2 inches and smaller, Model Type PS-1-2 with hanger for lines 3 inches and larger.
2. As manufactured by PHP Systems Design; Miro Industries Inc.; MAPA Products; Advanced Support Products, nVent Caddy or Architect approved equal.

B. Electrical Conduit / Condensate Lines:
1. Provide strut type support with recycled plastics and carbon black for UV protection bases (10 inches x 16 inches x 3 inches; 6 lbs. each), install with hold clips ordered as an accessory; Model Type PP-10 with strut. Model Type PS-1-2 with hanger for lines 3 inches and larger.
2. As manufactured by PHP Systems Design; Miro Industries Inc.; MAPA Products; Advanced Support Products, nVent Caddy or Architect approved equal.

C. Chill Water Lines:
1. Provide strut and hanger type support with recycled plastics and carbon black for UV protection bases (size as required); Model Type PS-1-2 and Model Type PSE-2-2 as required.
2. As manufactured by PHP Systems Design, Inc.; Miro Industries Inc.; MAPA Products; Advanced Support Products, nVent Caddy or Architect approved equal.

D. Installation:
1. Locate as indicated by Drawing at no greater than 8 feet-0 inches o.c.
2. Provide protective traffic pads below each support, tacked in place with approved mastic or adhesive.
3. Install hold down clips if indicated on the drawings or required.

2.4 ROOF TO ROOF EXPANSION JOINT

A. Stainless Steel expansion joint covers on new wood curbs, as detailed on drawings and outlined the NRCA and SMACNA manual.

2.5 SQUARE TUBE FLASHINGS

A. Basis of Design Manufacturer: SBC Industries; www.sbcflashings.com
1. Product: One or two piece as required for installation; refer to drawings for locations
a. 1 PC / Slipover SQUARE FLASHING – MODEL SQT/S
b. 2 PC / Divided SQUARE FLASHING – MODEL SQT/D

2. Materials:
a. Metal: 26 ga Stainless Steel, type 304, 2B finish ASTM A240
b. Solder: 50/50 (lead/tin) ASTM B32 or specify Non-lead ASTM 96.5TS
c. Backer Rod: Open cell foam, 7/8” ASTM 1564

3. Substitutions: Refer to section 01 25 13

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof accessories in accordance with manufacturer's printed instructions and approved shop drawings. Installation of Portable Pipe Hangers shall not exceed six (6) feet on center.

B. Coordinate with roofing operation for watertight integrity.

C. Finished installation shall be water and airtight. Install sealant conforming to FS TT-S-00227E, Type II, Class A.

END OF SECTION

SECTION 07 72 33 ROOF HATCH

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 RELATED WORK

A. Section 03 32 16- Lightweight Insulating Concrete Deck System

B. Section 05 31 00 - Metal Deck

C. Section 05 50 00 - Miscellaneous Metals

D. Section 06 10 00 - Rough Carpentry

E. Section 07 52 19 – Modified Bitumen Membrane Cool Roof Roofing System

1.3 SUBMITTALS

A. Product Data: Submit schedules, charts, literature and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.

B. Shop Drawings: Include materials, opening sizes, fabrication details, hardware, attachments, related and adjacent work, and finishes.

1.4 WARRANTY

A. Warrant the work specified herein for five (5) years, against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:
1. Faulty, improper or inadequate attachment or installation.
2. Difficult or noisy operation.
3. Noticeable deterioration of finish.
4. Leakage of water into the building or within the construction.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Specifications are based on products manufactured by The Bilco Company.

B. Manufacturers listed below whose products are equivalent to those specified are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing equivalent products to those specified and comply with Division 1 requirements regarding substitutions to be considered.
1. Babcock-Davis Hatchways, Inc.

2.2 ROOF HATCH

A. Size: 2 feet-6 inches x 3 feet-0 inches unless shown otherwise.

B. Thermally Broken Cover: Shall be 11 -gauge aluminum with 3" concealed polyisocyanurate insulation, 5" beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf live load., fully covered and protected by an aluminum liner.

C. Thermally Broken Curb: Shall be 12 inches in height and of 11-gauge aluminum. It shall be formed with a 5-1/2-inch flange with holes provided for securing to the roof deck. Curb shall be equipped with an integral metal capflashing of the same gauge and material as the curb, full welded at the corners for weathertightness. Capflashing shall be equipped with the Bilclip™ flashing system, including stamped tabs and Pak-Rope. Insulation on the exterior of the curb shall be rigid fiber board one (3) inches in thickness.

D. Thermally Broken Scuttle (Hatch): Shall be completely assembled with heavy pintle hinges, positive snap latch with turn handles, padlock hasps inside and outside, and a mechanically retained thermoplastic rubber gasket. Compression spring operators enclosed in telescopic tubes shall be provided for smooth, easy and controlled door operation throughout the entire arc of opening and closing. Operation shall not be affected by temperature. Cover shall be equipped with an automatic hold-open arm complete with red vinyl grip handle to permit easy release and one-hand control of the cover to its closed and latched position. All hardware shall be stainless steel. Scuttle factory finish shall be mill finish aluminum.

E. Approved Model / Manufacturer: Type No. “S-50TB” Roof Scuttles (Hatches) for ladder access, or Architect approved equal.

F. Ladder: As specified in Section 05 50 00, Miscellaneous Metals. Ladder shall be oriented and mounted along the short dimension of the hatch.

G. Fall Protection Safety Rail: 30”x36” Model SP-3036 Made by **SafePro L.C.**

PART 3 - EXECUTION

3.1 INSTALLATION

A. Roof hatches and heat / smoke vents shall be welded to structural steel frame of building.

B. Install hatches and heat / smoke vents in accordance with details on drawings, approved shop drawings, and manufacturer’s instructions.

END OF SECTION

SECTION 07 84 00 FIRESTOPPING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Penetrations for passage of duct, cable, cable tray, conduit, piping, electrical bus ways and raceways through fire rated vertical barriers (walls and partitions), horizontal beams (floor/ceiling assemblies) and vertical service shaft walls and partitions.

2. Safing slots gaps between edge of floor slabs and curtain walls.

3. Openings between structurally separate sections of walls and floors.

4. Gaps between tops of walls and ceiling or roof assemblies.

5. Expansion joints in fire rated walls and floors.

6. Openings and penetrations in fire rated partitions or walls containing fire doors.

7. Openings around structural members which penetrate fire rated floors or walls.

1.02 REFERENCES

A. ASTM International:

1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

2. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

3. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops.

4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems_

B. National Fire Protection Association: NFPA 70 National Electrical Code; NFPA 101 Life Safety Code; NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories Inc.:

1. UL 263 - Fire Tests of Building Construction and Materials.

2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.

3. UL 1479 - Fire Tests of Through-Penetration Firestops.

4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.

5. UL - Fire Resistance Directory.

1.03 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.04 PERFORMANCE REQUIREMENTS

A. Conform to applicable code for fire resistance ratings and surface burning characteristics.

B. Provide firestop systems which have been manufactured and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.05 SUBMITTALS

A. Product Data: Submit data on product characteristics, performance and limitation criteria.

B. Schedule: Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance rating of adjacent assembly.

C. Manufacturer's Installation Instructions: Submit preparation and installation instructions.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Through Penetration Firestopping of Fire Rated Assemblies: UL 1479 or ASTM E814 with 0.10 inch water gage minimum positive pressure differential to achieve fire F-Ratings and temperature T-Ratings as indicated, but not less than 1 -hour.

1. Wall Penetrations: Fire F-Ratings as indicated on Drawings, but not less than 1-hour.

2. Floor and Roof Penetrations: Fire F-Ratings and temperature T-Ratings as indicated on Drawings, but not less than 1 -hour.

a. Floor Penetrations Within Wall Cavities: T-Rating is not required.

B. Through Penetration Firestopping of Non-Fire Rated Floor and Roof Assemblies: Materials to resist free passage of flame and products of combustion.

1. Noncombustible Penetrating Items: Noncombustible materials for penetrating items connecting maximum of three stories.

2. Penetrating Items: Materials approved by authorities having jurisdiction for penetrating items connecting maximum of two stories.

C. Fire Resistant Joints in Fire Rated Floor, Roof, and Wall Assemblies: ASTM E1966 or UL 2079 to achieve fire resistant rating as indicated on Drawings for assembly in which joint is installed.

D. Fire Resistant Joints Between Floor Slabs and Exterior Walls: ASTM E119 with 0.10 inch water gage minimum positive pressure differential to achieve fire resistant rating as indicated on Drawings for floor assembly.

E. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

F. A qualified inspection agency shall check installed firestopping systems for compliance with requirements.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver the materials to the job site in the manufacturer’s unopened containers, containing the UL classification label, with all labels intact and legible at time of use.

B. Store materials in accord with manufacturer’s recommendations with proper precautions to ensure fitness of material when installed.

C. Before handling, read product data sheets and material safety data sheets. Do not use damaged or expired materials.

1.09 ENVIRONMENTAL REQUIREMENTS

A. Section 01 60 00 - Product Requirements.

B. Do not apply materials when temperature of substrate material and ambient air is below 60 degrees F.

C. Maintain this minimum temperature before, during, and for minimum 3 days after installation of materials.

D. Provide ventilation in areas to receive solvent cured materials.

1.10 WARRANTY

A. Deliver to the Architect signed copies of the following written warranties against material failure:
1. Manufacturer’s standard warranty covering firestop materials.
2. Applicator’s standard warranty covering workmanship.

B. Warranties shall cover a period of 2 years from the date of substantial completion.

PART 2 PRODUCTS

2.01 FIRESTOPPING

A. Product Description: Different types of products by multiple manufacturers are acceptable as required to meet specified system description and performance requirements; provide only one type for each similar application.

1. Acceptable Manufacturers

a. Thermal Ceramics
b. Tremco, Inc.
c. Flame-Safe (International Protective Coatings Corp.)
d. Specified Technologies
e. RectorSeal Corp.
f. 3M Fire Protection Products
g. Nelson Firestop Products
h. Hilti, Inc.

B. Firestopping Fill, Void, and Cavity Materials: Shall conform to those required by UL testing or other testing agency approved by authorities having jurisdiction, including, but not be limited to the following. Refer to list of approved manufacturers:

1. Cast-in place firestop devices for use with combustible and noncombustible pipes (closed and open piping systems) and cable bundles penetrating concrete floors, equal to the following products are acceptable:
a. "CP 680 Cast-In Place Firestop Device", Hilti, Inc. (Add Aerator adaptor when used in conjunction with aerator)("sovent") system.
b. "CP 681 Tub Box Kit" for use with tub installations, Hilti, Inc
c. "CP 682 Cast-In Place Firestop Device" for use with noncombustible penetrants, Hilti, Inc.

2. Sealants, caulking materials, or foams for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), equal to the following products are acceptable:
a. "FS-ONE Intumescent Firestop Sealant", Hilti, Inc.
b. "CP 604 Self-leveling Firestop Sealant", Hilti, Inc.
c. "CP 620 Fire Foam", Hilti, Inc.
d. "CP 606 Flexible Firestop Sealant", Hilti, Inc.
e. "CP 601s Elastomeric Firestop Sealant", Hilti, Inc,

3. Sealants or caulking materials for use with sheet metal ducts, equal to the following products are acceptable:
a. "CP 601s Elastomeric Firestop Sealant", Hilti, Inc.
b. "CP 606 Flexible Firestop Sealant", Hilti, Inc.
c. "FS-ONE Intumescent Firestop Sealant", Hilti, Inc.

4. Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, equal to the following products are acceptable:

a. "FS-ONE Intumescent Firestop Sealant", Hilti, Inc

5. Foams, Intumescent sealants, or caulking materials for use with flexible cable or cable bundles, equal to the following products are acceptable:

   a. "FS-ONE Intumescent Firestop Sealant", Hilti, Inc
   b. "CP 620 Fire Foam", Hilti, Inc
   c. "CP 601 s Elastomeric Firestop Sealant", Hilti, Inc
   d. "CP 606 Flexible Firestop Sealant", Hilti, Inc

6. Non curing, re-penetrable, intumescent putty or foam materials for use with flexible cable or cable bundles, equal to the following products are acceptable:
   a. "CP 618 Firestop Putty Stick", Hilti, Inc
   b. "CP 658T Firestop Plug", Hilti, Inc

7. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, equal to the following products are acceptable:

   a. "CP 617 Firestop Putty Pad" manufactured by Rib, Inc.

8. Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems), equal to the following products are acceptable:

   a. "CP 643N Firestop Collar", Hilti, Inc
   b. "CP 644 Firestop Collar", Hilti, Inc
   c. "CP 645/648 Wrap Strips", Hilti, Inc.

9. Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, equal to the following products are acceptable:

   a. "CP 637 Firestop Mortar", Hilti, Inc
   b. "FS 657 FIRE BLOCK" , Hilti, Inc
   c. "CP 620 Fire Foam", Hilti, Inc
   d. "CP 675T Firestop Board", Hilti, Inc

10. Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, equal to the following products are acceptable:

    a. "FS 657 FIRE BLOCK", Hilti, Inc
    b. "CP 675T Firestop Board", Hilti, Inc.

11. For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, equal to the following products are acceptable:

    a. "FS 657 FIRE BLOCK", Hilti, Inc
    b. "CP 658T Firestop Plug", Hilti, Inc

C. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.
   1. Manufacturers: FireMaster Bulk and FireMaster Mastic, Thermal Ceramics
      www.thermalceramics.com

D. Endothermic, Latex Compound Sealant. Single-component, endothermic, latex formulation.

1. Manufacturers:

a. Fyre-Shield, Tremco, Inc. www.tremcosealants.com
b. Flame-Safe FS900/FST900 Series, International Protective Coatings Corp. www.flamesafe.com

E. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.

1. Manufacturers:

a. SpecSeal Triple S Intumescent Sealant, Specified Technologies Inc.
b. SpecSeal LCI Intumescent Sealant, Specified Technologies Inc.
c. Metacaulk 950, The RectorSeal Corporation. www.rectorseal.com/firestopping/fp2.htm
d. Fire Barrier CP 25WB + Caulk, 3M Fire Protection Products. www.3m.com/firestop
e. Tremstop IA, Tremco, Inc.

F. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.

1. Manufacturers:

a. SpecSeal Series SSP Firestop Putty and Putty Pads, Specified Technologies Inc. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
b. Fire Barrier Moldable Putty +, 3M Fire Protection Products.

G. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.

1. Manufacturers:

a. SpecSeal Series SSW Wrap Strips, Specified Technologies Inc. FS 601 Intumescent Wrap, Hilti Construction Chemicals, Inc. www.us.hilti.com
b. Fire Barrier FS-195 + Wrap/Strip, 3M Fire Protection Products.
c. Tremstop WS, Tremco, Inc.

H. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings, of zero per ASTM E 84.

1. Manufacturers: USG Firecode Compound, United States Gypsum Co. www.usg.com

I. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.

1. Manufacturers:
a. SpecSeal Series SSM Mortar, Specified Technologies Inc.
b. KBS-Mortar Seal, International Protective Coatings Corp.
c. Tremstop M, Tremco, Inc.

J. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.

1. Manufacturers:

a. KBS Sealbags, International Protective Coatings Corp.
b. Tremstop PS, Tremco, Inc.

K. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.

1. Manufacturers:

a. Fire Barrier 2001 Silicone ATV Foam, 3M Fire Protection Products.
b. Pensil 200 Foam, General Electric Co. www.ge.com/silicones

L. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2. Manufacturers:

a. PENSIL Series PEN300 Silicone Sealant, Specified Technologies Inc.
b. 2000 Silicone Sealant, 3M Fire Protection Products.
c. FS 601 Firestop Sealant, Hilti Construction Chemicals, Inc.
d. Metacaulk 835 +, The RectorSeal Corporation. www.rectorseal.com
e. Metacaulk Pipe Collars, The RectorSeal Corporation.
f. Fyre-Sil, Tremco Inc.
g. Fyre-Sil S/L, Tremco Inc.

M. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

N. Fire Related Construction Joints and Other Gaps:

1. "CP 601 S" Elastomeric Firestop Sealant" manufactured by Hilti, Inc.
2. "CP 606" Flexible Firestop Sealant" manufactured by Hilti, Inc.
3. "CP 672" Firestop Joint Speed Spray" manufactured by Hilti, Inc.

O. Fire Safing Materials: Comply with ASTM C665, Type I, high-melt mineral-fiber insulation with minimum nominal density of 4.0 lbs. per cubic foot and having a maximum flame spread rating of 15 and smoke developed rating of 0. Size shall be 4 inches thick by 24 inches wide by 48 inches long, unless noted otherwise. Products containing asbestos strictly prohibited.

1. "Thermafiber Safing Insulation" manufactured by Thermafiber, Inc.
2. "Fibrex Safing Insulation" manufactured by Fibrex Insulations, Inc.
3. "Delta Safing Board" manufactured by Rock Wool Manufacturing Company.

P. Jacketing (For use with fire protection board): 0.016 inch aluminum or 0.010 inch stainless steel roll jacketing as shown, or if not shown, as required where high traffic requires high durability and good appearance, and as directed by Architect.

2.02 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
1. Sealant Colors: As selected.

B. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) 0.
1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and regain in compliance with other requirements of ASTM C 920 for uses indicated:
   a. 50 percent movement in both extension and compression for a total of 100 percent movement.
   b. 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.

2. Manufacturers:
   a. Dow Corning 790, Dow Corning Corp. www.dowcorning.com
   b. Dow Corning 795, Dow Corning Corp.
   c. Silpruf SCS 2000, General Electric Co.
   d. Ultraglaze SSG 4000, General Electric Co.
   e. 864, Pecora Corp. www.pecora.com
   f. Fyre-Sil, Tremco, Inc.

C. Multi-component, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:

   a. 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.
   b. 50 percent movement in both extension and compression for a total of 100 percent movement.

2. Manufacturers:
   a. Vulkem 922, Mameco International Inc.
   b. Dynflex, Pecora Corp.
   c. Dynatred, Pecora Corp.
   d. Dynatrol II, Pecora Corp.
   e. Sikaflex 2cn NS, Sika Corp. www.sikausa.com
   f. Sonolastic NP 2, Sonneborn Building Products www.chemrex.com
   g. Dymeric, Tremco Inc.

D. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.

1. Manufacturers:
   a. Isoflex 880 GB, Harry S. Peterson Co., Inc.
   b. Isoflex 881, Harry S. Peterson Co., Inc.
   c. Vulkem 921, Mameco International Inc.
   d. Sikaflex 15LM, Sika Corp.

2.03 ACCESSORIES

A. Primer: Type recommended by firestopping manufacturer for specific substrate surfaces and suitable for required fire ratings.

B. Installation Accessories: Provide clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive firestopping.

B. Examine joints and openings indicated or required to receive firestop and fire safing materials, for compliance with requirements for proper configuration, installation tolerances and other conditions affecting firestop and fire safing performance.

C. Do not proceed with installation until unsatisfactory conditions are corrected.

D. Beginning installation shall indicate acceptance of existing conditions. Work found to be defective or deficient due to uncorrected existing conditions prior to installation should be repaired or replaced at no additional expense to Owner.

3.02 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

1. Verify penetrations are properly sized and in suitable condition for application of materials.

2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

4. Install back-up (damming) materials to arrest liquid material leakage.

5. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

3.03 COORDINATION

A. Coordinate location and proper selection of cast-in-place firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trades to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.04 APPLICATION

A. Install material at fire rated construction perimeters and openings containing penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping.

B. Apply primer where recommended by manufacturer for type of firestopping material and substrate involved, and as required for compliance with required fire ratings.

C. Apply firestopping material in sufficient thickness to achieve required fire and smoke rating.

D. Compress fibered material to maximum 40 percent of its uncompressed size.

E. Place foamed material in layers to ensure homogenous density, filling cavities and spaces. Place sealant to completely seal junctions with adjacent dissimilar materials.

F. Place intumescent coating in sufficient coats to achieve rating required.

G. Remove dam material after firestopping material has cured.

3.05 FIELD QUALITY CONTROL

A. Inspecting agency shall examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

B. Inspecting agency will report observations promptly and in writing to Contractor and Architect.

C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.

D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

3.06 CLEANING AND PROTECTION

A. Clean adjacent surfaces of firestopping materials.

B. Protect adjacent surfaces from damage by material installation.

END OF SECTION 07 84 00

SECTION 07 90 00 JOINT PROTECTION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this Section.

1.02 SUMMARY

A. Scope includes sealing of all joints and points of contact between different materials in exterior envelope of building, leaving no gaps in exterior of building that allows penetration by moisture, insect or bats. Extent of each form and type of joint sealer is indicated below and supplemental information shall be found on the drawings.

B. Section includes sealers for the following exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

1. Control and expansion joints in cast-in-place concrete.
2. Control and expansion joints in pre-cast concrete.
3. Control and expansion joints in unit masonry.
4. Joints between different materials listed above.
5. Perimeter joints between materials listed above and frames of doors and windows.
6. Control and expansion joints in ceiling and overhead surfaces.
7. Control and expansion joints in tilt-wall concrete panels (if tilt wall system is used)
8. Other joints as indicated.

C. Section includes sealers for exterior joints in horizontal traffic surfaces as indicated below:

1. Control, expansion, and isolation joints in cast-in-place concrete slabs for floors and paving.
2. Joints between different materials listed above.
3. Other joints as indicated.

D. Section includes sealers for interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:

1. Control and expansion joints on exposed interior surfaces of exterior walls.
2. Perimeter joints of exterior openings.
3. Joints between tops of non-load-bearing unit masonry walls and underside of structural deck and beams.
4. Tile control and expansion joints.
5. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
6. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
7. Perimeter joints of toilet fixtures.
8. Other joints as indicated.

E. Sealing joints and penetrations for firestopping is specified in Division 7, Section 07 84 00 - "Firestopping" for through-penetration firestopping systems.

F. Sealing joints related to flashing and sheet metal for roofing is specified in Division 7, Section

07 62 00 - “Sheet Metal Flashing, Trim, and Accessories".

G. Sealants for glazing purposes are specified in Division 8, Section 08 80 00 and 08 88 13 - "Glass and Glazing."

H. Sealing tile joints is specified in Division 9, Section 09 30 00 - "Tiling."

1.04 REFERENCE STANDARDS

A. All adhesives and sealants used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the requirements of the following:

1. Adhesives, Sealants and Sealant Primers: Current South Coast Air Quality Management District (SCAQMD) Rule #1168.

2. Aerosol Adhesive shall comply with Green Seal Standard for Commercial Adhesives GS-36 requirements.

B. SEALANT CLASSIFICATIONS

1. Material Composition
   a. Type S – Single Component
   b. Type M – Multi-Component

2. Application Characteristic
   a. Grade P – Flowable & Self-leveling for horizontal expansion
   b. Grade NS – Non-Sag or gun grade for use on vertical expansion

3. Classification
   a. Class 25 – Passes 25% movement per ASTM C719
   b. Class 12 ½ - Passes 12 ½% movement per ASTM C719

4. Use
   a. Use T – Traffic areas
   b. Use NT – Non-traffic areas
   c. Use M – passes ASTM C794 & C710 on mortar
   d. Use G – passes ASTM C794 & C719 on glass
   e. Use A – passes C794 & C719 on aluminum
   f. Use O – passes ASTM C794 & C719 on other substrates

1.03 SYSTEM PERFORMANCE

A. Provide joints sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.04 SUBMITTALS

A. Product Data from manufacturer's for each joint sealer product required, including instructions for joint preparation and joint sealer application.

B. Samples for Initial Selection Purposes: Manufacturer's standard bead samples consisting of exposed to view strips of actual products showing full range of colors available, for each product exposed to view.

C. Samples for verification purposes of each type and color of joint sealer required. Install joint sealer samples in 1/2 inch wide joints formed between two 6 inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealers.

D. Certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.

E. Qualification data complying with requirements specified in "Quality Assurance" article. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.

F. Product test reports for each type of joint sealers indicated, evidencing compliance with requirements specified.

G. If LEED certification is required on project, Submit all required LEED documentation for mandatory and desirable credits noted in paragraph 1.10 per the submittal requirements outlined in Section 01 33 29.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has successfully completed, within the last 3 years, at least 3 joint sealer applications similar in type and size to that of this Project.

B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

C. Pre-Installation Conference: Conduct conference at Project site to comply with requirements of the Division-1 section covering this activity.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi-component materials.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 deg F.

2. When joint substrates are wet due to rain, frost, condensation or other causes.

B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.

C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants

capable of interfering with their adhesion are removed from joint substrates.

1.08 SEQUENCING AND SCHEDULING

A. Sequence installation of joint sealers to occur not less than 21 nor more than 30 days after completion of waterproofing, unless otherwise indicated.

1.09 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

C. Warranty Period: Two years from date of Substantial Completion.

D. Special Manufacturer's Warranty: Written warranty, signed by elastomeric sealant manufacturer agreeing to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

E. Warranty Period: 5 years from date of Substantial Completion.

F. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:
1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.

2. Disintegration of joint substrates from natural causes exceeding design specifications.

3. Mechanical damage caused by individuals, tools, or other outside agents.

4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

B. Colors: Provide a color of exposed joint sealer as selected by Architect from manufacturer's standard colors.

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class and Uses.

B. One-Part Mildew-Resistant Silicone Sealant: Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide; intended for sealing interior joints with nonporous substrates and subject to in-service exposure to conditions of high humidity and temperature extremes.

1. Application: Interior vertical and non-traffic horizontal joints in wet areas (e.g. showers, kitchens, perimeter joints of toilet fixtures).

2. Available Products:

a. "Dow-Corning 786"; Dow Corning Corp. www.dowcorning.com
b. "SCS 1700 Sanitary"; General Electric Co. www.gesealants.com
c. "860 White"; Pecora Corp. www.pecora.com
d. "Rhodorsil 6B White"; Bluestar Silicones, www.bluestarsilicones.com
e. "Tremsil 200"; Tremco, Inc. www.tremcosealants.com
f. "OmniPlus"; Sonneborn Building Products Div. of Chemrex, Inc. www.chemrex.com

C. One-Part Nonsag Urethane Sealant for Use NT: Type S; Grade NS; Class 25; and Uses NT,M, A, and, as applicable to joint substrates indicated, O;

1. Application: Exterior joints in vertical surfaces and non-traffic horizontal surfaces as indicated below:

a. Control and expansion joints in cast-in-place concrete.
b. Control and expansion Joints in unit masonry.
c. Joints between different materials listed above.
d. Perimeter joints between materials listed above and frames of doors and windows.
e. Control and expansion joints in ceiling and overhead surfaces.
f. Other joints as indicated.
g. Control and expansion joints in tilt-up concrete

2. Available Products:

a. "Chem-Calk 900"; Bostik Construction Products Div. www.bostik.com
b. "Vulkem 116"; Tremco, Inc. www.tremcosealants.com
c. "Dynatrol I-XL"; Pecora Corp. www.pecora.com
d. "Sikaflex-1a"; Sika Corp. www.sika.com
e. "Sikaflex-15LM"; Sika Corp. www.sika.com
f. "MasterSeal NP 1"; BASF Chemical Co.
g. "Dymonic"; Tremco, Inc. www.tremcosealants.com

D. One-Part Nonsag Urethane Sealant for Use T: Type S; Grade NS; Class 25, and complying with the following requirements for Uses:

1. Uses T, NT, A, and, as applicable to joint substrates indicated, O.

2. Application: Exterior horizontal joints subject to vehicular and pedestrian traffic. Interior horizontal joints subject to vehicular and pedestrian traffic and not indicated to

receive expansion control assemblies.

3. Available Products:

a. "Chem-Calk 900"; Bostik Construction Products Div. www.bostik.com
b. "Sikaflex-1a"; Sika Corp. www.sika.com
c. "Sikaflex-15LM";Sika Corp. www.sika.com
d. "MasterSeal NP 1", BASF Chemical Co.
e. "Vulkem 116"; Tremco, Inc. www.tremcosealants.com

E. Single Part Pourable Urethane Sealant for Use T (at exterior paving): Type S; Grade P; Class 25, and complying with the following requirements for Uses:

1. Uses T, A, and, as applicable to joint substrates indicated, O.

2. Application: Exterior horizontal joints subject to vehicular and pedestrian traffic.

3. Available Products:

a. "Vulkem 45, Vulkem 45SSL"; Tremco, Inc. www.tremcosealants.com
b. "NR-201 Urexpan"; Pecora Corp. www.pecora.com
c. "SL 2"; Sonneborn Building Products Div., Chemrex Inc. www.chemrex.com

2.03 LATEX JOINT SEALANTS

A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, acrylic, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be painted and recommended for exposed applications on interior and on protected exterior locations involving joint movement of not more than plus or minus 5 percent.

1. Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces as indicated below:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings.
c. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
d. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
e. Other joints as indicated.

2. Available Products:

a. "Chem-Calk 600"; Bostik Construction Products Div, www.bostik.com
b. "AC-20"; Pecora Corp. www.pecora.com
c. "Sonolac"; Sonneborne Building Products Div.Sonneborn Building Products Div., Chemrex Inc. www.chemrex.com
d. "Tremflex 834"; Tremco Inc. www.tremcosealants.com

2.04 MISCELLANEOUS JOINT SEALANTS

A. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

1. Available Products:

   a. "BA-98"; Pecora Corp. www.pecora.com
   b. "Tremco Acoustical Sealant"; Tremco Inc. www.tremcosealants.com
   c. “Sheetrock Brand Acoustical Sealant”, USG Corp. www.usg.com

2.05 COMPRESSION SEALS

A. Preformed Foam Sealant: Manufacturer's standard preformed, precompressed, impregnated open-cell foam sealant manufactured from high-density urethane foam impregnated with a nondrying, water repellant agent; factory-produced in precompressed sizes and in roll or stick form to fit joint widths indicated and to develop a watertight and airtight seal when compressed to the degree specified by manufacturer; and complying with the following requirements:

   1. Properties: Permanently elastic, mildew-resistant, non-migratory, non-staining, compatible with joint substrates and other joint sealers.

      a. Impregnating Agent; Manufacturer's standard.
      b. Density: Manufacturer's standard.

   2. Backing: Where required, provide backings suitable for intended use, compatible with joint substrates and other joint sealers, designed to work in conjunction with primary sealants in dual- sealant systems.

   3. Available Products:

      a. "Emseal"; Emseal Corp. www.emseal.com
      b. "Emseal Greyflex"; Emseal Corp. www.emseal.com
      c. "Polytite R"; Polytite Manufacturing Co., Inc. www.polytite.com
      d. "Polytite Standard"; Polytite Manufacturing Co., Inc. www.polytite.com
      e. 'Will-Seal 150"; Will-Seal Construction Foams Div.
      f. "Will-Seal 250"; Will-Seal Construction Foams Div.
      g. "York-Seal 100"; York Manufacturing, Inc. www.yorkflashings.com
      h. "York-Seal 200"; York Manufacturing, Inc. www.Vorkflashings.com

B. Preformed Hollow Neoprene Gasket: Manufacturer's standard preformed polychlorophene elastomeric joint seal of the open-cell compression type complying with ASTM D 2628 and with requirements indicated for size, profile and cross-sectional design.

   1. Available Manufacturers:

      a. Watson-Bowman & Acme Corp. www.watsonbowman.com
      b. The D.S. Brown Co. www.dsbrown.com

2.06 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

1. Install only closed-cell or dual-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer, for cold-applied sealants only.

C. Elastomeric Tubing Joint-Fillers: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, non-absorbent to water and gas, capable of remaining resilient at temperatures down to -26 deg F (-15 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaners of type which are acceptable to manufacturer of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.

C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

2.08 JOINT FILLERS FOR EXTERIOR CONCRETE PAVING

A. General: Provide joint fillers of thickness and widths indicated.

1. Bituminous Fiber Joint Filler: Preformed strips of composition below, complying with ASTM D 1751:

a. Asphalt saturated fiberboard - “Fiber Board”, APS Cork Co. or approved equal.

PART 3 - EXECUTION

3.01 EXAIMINATION

A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

1 Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form release agents from concrete.

4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.

D. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications and conditions indicated.

E. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

1. Install joint-fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.

2. Do not leave gaps between ends of joint-fillers.

3. Do not stretch, twist, puncture or tear joint fillers.

4. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material.

5. Install bond breaker tape between sealants and joint-fillers, compression seals or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.

F. Install compressible seals serving as sealant backings to comply with requirements indicated above for joint fillers.

G. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

H. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.

2. Provide flush joint configuration per Figure 6B in ASTM C 962, where indicated.

3. Use masking tape to protect adjacent surfaces of recessed tooled joints.

4. Provide Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations indicated.

I. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrappings, taking care not to pull or stretch material, and complying with sealant manufacturer's directions for installation methods, materials and tools which produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

J. Installation of Preformed Hollow Neoprene Gaskets: Install gaskets, with minimum number of end joints, in joint recesses with edges free of spalls and sides straight and parallel, both within tolerances specified by gasket manufacturer. Apply manufacturer's recommended adhesive to joint substrates immediately prior to installing gaskets. For straight sections

provide gaskets in continuous lengths; where changes in direction occur, adhesively splice gaskets together to provide watertight joint. Recess gasket below adjoining joint surfaces by 1/8 inch to 1/4 inch.

3.04 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

3.05 PROTECTION

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

END OF SECTION 07 90 00

SECTION 07 95 13 EXPANSION JOINT COVER ASSEMBLIES

PART 1 – GENERAL REQUIREMENT

1.01 SCOPE

A. Provide interior floor, wall and ceiling expansion joint covers as and specified. See below for each expansion joint condition. Refer to structural and architectural drawings for location of expansion joints.

1.02 QUALITY ASSURANCE

A. Project Conditions:

1. Check actual locations of walls and other construction, to which work must fit, by accurate field measurements before fabrication.

2. Show recorded measurements on final shop drawings.

B. Fire tests performed by Factory Mutual, Underwriters Laboratories, Inc., Warnock Hersey or other approved independent testing laboratory.

1.03 DELIVERY STORAGE AND HANDLING

A. Take care in handling of materials so as not to injure finished surface and components.

B. Store materials under cover in a dry and clean location off the ground.

C. Remove materials which are damaged or otherwise not suitable for installation from job site and replace with acceptable materials.

1.04 SUBMITTALS

A. Submit in accordance with Section 01 33 00 – Submittal Procedures..

B. Manufacturer's Literature and Data:

1. Submit copies of manufacturer's current literature and data for each item specified.

2. Clearly indicate movement capability of cover assemblies // and suitability of material used in exterior seals for ultraviolet exposure //.

C. Certificates: Material test reports from approved independent testing laboratory indicating and interpreting test results relative to compliance of fire-rated expansion joint assemblies with requirements specified.

D. Shop Drawings:

1. Showing full extent of expansion joint cover assemblies; include large-scale details indicating profiles of each type of expansion joint cover assembly, splice joints between sections, joiners with other type assemblies, special end conditions, anchorages, fasteners, and relationship to adjoining work and finishes.

2. Include description of materials and finishes and installation instructions.

E. Samples:

1. Samples of each type and color of metal finish on metal of same thickness and alloy used in work.

1.05 APPLICABLE PUBLICATIONS

A. Publications listed form part of this specification to extent referenced. Publications are referred to in text by basic designation only.

B. American Society for Testing and Materials (ASTM):

A36/A36M-05	Structural Steel
A167-99 (R2004)	Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
A283/A283M-03	Low and Intermediate Tensile Strength Carbon Steel Plates
A786/A786M-05	Rolled Steel Floor Plates
B36/B36M-06	Brass, Plate, Sheet, Strip, and Rolled Bar
B121-01(R2006)	Leaded Brass Plate, Sheet, Strip and Rolled Bar
B209M-06	Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
B221M-06	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)
B455-05	Copper-Zinc Lead Alloy (Leaded Brass) Extruded Shapes
C864-05	Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
C920-05	Elastomeric Joint Sealants
D1187-97 (R2002)	Asphalt Base Emulsions for Use as Protective Coatings for Metal
D2287-96 (R2001)	Non-rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
E119-07	Fire Tests of Building Construction and Materials
E814-06	Fire Tests of Through-Penetration Fire Stops

C. Federal Specifications (Fed. Spec):
TT-P-645B Primer, Paint, Zinc-Molybdate, Alkyd Type

D. The National Association of Architectural Metal Manufacturers (NAAMM):
AMP 500 Series Metal Finishes Manual.

E. National Fire Protection Association (NFPA):
251-05 Tests of Fire Endurance of Building Construction and Materials

F. Underwriters Laboratories Inc. (UL):
263-03 Fire Tests of Building Construction and Materials

PART 2 - PRODUCTS

2.01. APPROVED MANUFACTURERS

A. Aluminum expansion joint closures shall be as manufactured by Balco, Inc., MM Systems, Construction Specialties, In-Pro Corp., Pawlings, and Metalines are approved manufacturers.

Type 1: Floor to Floor Type:	Balco - Type GF-1S In-Pro – Type 801-A01-025 C/S – Type PC-100
Type 2: Wall to Wall at 90 º Corners:	Balco Type WDC-1 (snap-on) or 1C1 (clip-in) In-Pro – Type 804-A09-050
Type 3: Wall to Wall (Inline):	Balco - Type WD-1 (snap-on) or 1W1 (clip-in) In-Pro – Type 804-A07-050
Type 4: Floor to Wall:	Balco - Type GC-1 In-Pro – Type 804-A02-050 C/S – Type PCW-100
Type 5: Ceiling to Ceiling at Gypsum Board Ceiling Areas:	Balco - Type C1W1 (clip-in) In-Pro – Type 804-A07-050
Type 5A: Ceiling to Ceiling at Suspended Acoustical Grid:	Balco – Type AC-1 In-Pro – Type 115-A24-050
Type 6: Ceiling to Wall at Gypsum Board Ceiling Areas:	Balco - Type C1C1 (clip-in) In-Pro – Type 804-A07-025

Note: At fire-rated floor and wall assemblies, provide similar expansion joint covers designed to maintain fire rating of floor or wall assembly.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Manufacturer’s representative shall make a thorough examination of surfaces receiving work of this section.

B. Before starting installation, notify prime contractor of defects which would affect satisfactory completion of work.

3.02 PREPARATION

A. Verify measurements and dimensions at job site and cooperate in coordination and scheduling of work with work of related trades.

B. Give particular attention to installation of items embedded in concrete and masonry so as not to delay job progress.

C. Provide templates to related trade for location of support and anchorage items.

3.03 INSTALLATION

A. Install in accordance with manufacturers installation instructions unless specified otherwise.

B. Provide anchorage devices and fasteners for securing expansion joint assemblies to in-place construction including threaded fasteners with drilled-in fasteners for masonry and concrete where anchoring members are not embedded in concrete. Provide metal fasteners of type

and size to suit type of construction indicated and provide for secure attachment of expansion joint cover assemblies.

C. Perform cutting, drilling and fitting required for installation of expansion joint cover assemblies.

D. Install joint cover assemblies in true alignment and proper relationship to expansion joint opening and adjoining finished surfaces measured from established lines and levels.

E. Allow for thermal expansion and contraction of metal to avoid buckling.

F. Set floor covers at elevations flush with adjacent finished floor materials unless shown otherwise.

G. Material and method of grouting floor frames set in prepared recesses in accordance with manufacturer's instructions.

H. Locate wall, ceiling and soffit covers in continuous contact with adjacent surfaces. Securely attach in place with required accessories.

I. Locate anchors at interval recommended by manufacturer, but not less than 75 mm (3-inches) from each ends, and, not more than 600 mm (24-inches) on centers.

J. Maintain continuity of expansion joint cover assemblies with end joints held to a minimum and metal members aligned mechanically using splice joints.

K. Cut and fit ends to produce joints that will accommodate thermal expansion and contraction of metal to avoid buckling of frames or plates.

L. Flush Metal Cover Plates:

1. Secure flexible filler between frames so that it will compress and expand.

2. Adhere flexible filler materials to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

M. Waterstops:

1. Install in conjunction with all floor joints and other joints where shown, run continuously to prevent water damage to finish spaces.

2. Provide seal with frame to prevent water leakage.

3. Provide outlet tubes from waterstops to drain to prevent damage to finish spaces.

N. Fire Barriers:

1. Install in compliance with tested assembly.

2. Install in floors and in fire rated walls.

3. Use fire barrier sealant or caulk supplied with system.

O. Sealants: Install to prevent water and air infiltration.

P. Vertical Exterior Extruded Thermoplastic Rubber.

1. Install side frames mounted on sealant or butyl caulk tape with appropriate anchors 600 mm (24 inches) on center complete with independent continuous PVC back seal.

2. Install primary seals retained in extruded aluminum side frames.

Q. Installation of Extruded Thermoplastic Rubber or Seals:

1. For straight sections, provide preformed seals in continuous lengths.

2. Vulcanize or heat-seal field splice joints to provide watertight joints using manufacturer's recommended procedures.

R. Installation of Preformed Elastomeric Sealant Joint:

1. Locate joint directly over joints in wall or floor substrates.

2. Full length shall be fastened to substrate using a construction adhesive.

3. Install flush or slightly below finish material.

3.04 PROTECTION

A. Take proper precautions to protect the expansion joint covers from damage after they are in place.

B. Cover floor joints with plywood where wheel traffic occurs.

END OF SECTION 07 95 13

SECTION 08 11 00 HOLLOW METAL DOORS & FRAMES

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all labor, materials, equipment, and miscellaneous apparatus required to fabricate, deliver, and install all hollow metal doors, frames, and related items. The work under this section to include the furnishing of all items shown on the drawings and as specified, including, but not limited to, the following.

1. Hollow Metal Doors
2. Hollow Metal Frames
3. Steel Side lite, Borrowed lite & transom frames
4. Louvers Installed in Steel Doors

1.02 REFERENCES

A. Steel Doors and Frames in this section must meet all standards as established by the following listing.

1. Door and Hardware Preparation ANSI 115.1.
2. Life Safety Codes NFPA-101 (Latest edition)
3. Fire Doors and Windows NFPA-80 (Latest edition).
4. Steel Door Institute ANSI/SDI-100 (Latest edition).
5. UL 10 B Fire test of Door Assemblies and UL10C Standard for Positive Pressure Fire Tests of Door Assemblies

1.03 SUBMITTALS

A. Coordinate approved shop drawings with all other trades and manufacturers whose products are used in conjunction with the Steel Doors and Frames under section 08100.

B. Finish hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Structural Analysis Data: Include structural analysis data and shop drawings related to system anchorage that are signed and sealed by the Professional Engineer registered in the state of Texas who is responsible for their preparation. Engineer shall also provide structural analysis data, signed and sealed, for system Performance Requirements that are not certified by manufacturer.

D. Each floor of the building is to be detailed separately.

E. Shop drawings shall show gauges of metals, anchors, dimensions, weights and sizes of members, details of construction and installation with particular regard to connection and joining to other materials and locations of units in building.

F. The steel door and frame supplier will furnish to the architect (4) complete copies of the proposed steel door and frames schedule and/or shop drawings. Using the same reference number for details and openings as those on the contract drawings. After receipt of the approved door schedule the steel door and frame supplier will make any corrections and submit to the architect (6) sets of corrected schedules.

G. If any opening is not by the steel door manufacturer only the door opening number should be shown along with the type of door (wood etc.).

H. Upon request of the architect or for any substitution to this specification,(4)copies of the door & frame manufacturers catalog cut sheets are to be submitted to the architect before any material is placed on the job.

1.04 QUALITY ASSURANCE

A. Provide Steel Doors and Frames complying with the Steel Door Institute recommended specifications for Standard Steel Doors and Frames ANSI/SDI 100 (Latest edition).

B. Steel Doors and frames shall be manufactured to high quality standards in manufacturing facilities with annual certified conformance to ISO9001.

C. Door manufactured to provide a lifetime warranty on all doors specified as Imperial MAXIM (polyurethane) or Medallion MAXIM (steel stiffened)

D. Doors and frames shall meet the minimum standards of recommended specifications for hollow metal doors and frames as published by the NAAMM (National Association of Architectural Metal Manufacturers) latest edition.

1.05 DELIVERY, STORAGE AND HANDLING

A. Doors and frames must be properly marked with the door opening mark number to correspond with the schedule.

B. Deliver all steel doors with corrugated edge protection and palletized to provide protection during transit and job storage.

C. Inspect doors and frames upon delivery for damage. Minor damage is to be repaired, provided the repair is equal to new work and acceptable to the architect.

D. Store doors and frames at the site under cover. Place units on wood sills on the floor in a manner that will prevent rust and damage. Avoid the use of non-vented plastic or canvas shelters which could create a humidity chamber. If the wrapper on the door becomes wet, remove the carton immediately. Provide a ¼ inch space between stacked doors to promote air circulation.

E. Door and frame fabrication shall take into account that they will be painted (Specification Section 09 90 00) utilizing enamel paint. All surfaces shall be smooth; no scratches, dents, ripples, etc. Visible spot welds, transfer effect of “Z” bar stiffeners or other concealed construction members to surface are not allowed.

1.06 MEASUREMENTS

A. Obtain all necessary measurements at job site and layout to fit the job conditions. The drawings shall not be scaled nor written dimensions thereon be used without verification in the field.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers/Suppliers:

1. Amweld Building Products, Inc. www.amweld.com
2. Ceco Door Products, www.cecodoor.com
3. Copco Door Co., www.copcodoor.com
4. Curries Mfg. Company, www.curries.com
5. DeanSteel Mfg. Co., www.deansteel.com
6. Door Pro Systems, Inc. www.doorpro.com
7. Mesker Door, Inc. www.meskerdoor.com
8. Pearland Industries, Pearland, Texas;
9. Pioneer Industries, Inc. www.pioneerindustries.com
10. Republic Builders Products, www.republicdoor.com
11. Steelcraft Doors, Allegion

2.02 MATERIALS - GENERAL

A. All steel for exposed parts of hollow metal work shall be first quality cold-rolled pickled and patten leveled bonderized open-hearth furniture steel. Gauges of steel shall be such that the work shall be substantially constructed and its surfaces shall be smooth and level under normal use, but in no case shall the metal be lighter than the gauge specified herein or shown on the drawings.

B. Sound and fire retarding materials for hollow metal doors shall be heat-retarding filler conforming to the requirements of the National Fire Protection Association.

C. Expansion bolts shall be cinched tight, galvanized.

D. Shop Finish: Baked-on minimum filler plus baked-on rust inhibited primer. Exterior doors and hollow metal frames shall be fabricated from galvanized sheet; cut edges shall be gray galvanized after fabrication.

2.03 HOLLOW METAL DOORS

A. Exterior Doors

1. Sheets are to be made of commercial quality hot dipped zinc coated steel that complies with ASTM A924 and A653.

2. Hinge reinforcements shall be no less than 7 gage plate 1-1/4” X full height of the door. The reinforcement will be drilled and tapped in the field.

3. Vertical edges shall join the face sheets by a continuous weld extending the full height of the door. Welds are to be ground, filled and dress smooth to make them invisible and provide a smooth flush surface.

4. Reinforce tops and bottoms of all doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to both face sheets. Doors

with an inverted top channel shall have a steel closure channel screwed or welded in place so the web of the channel is flush with the top of the face sheets of the door. Plastic fillers are NOT acceptable.

B. Interior Doors

1. Face sheets are to be made of commercial quality cold rolled steel that complies with ASTM A366 or 620.

2. Vertical edges shall join the face sheets by a continuous weld extending the full height of the door. Welds are to be ground, filled and dress smooth to make them invisible and provide a smooth flush surface.

3. Hinge reinforcement shall be not less than 7 gage (3/16") plate 1-1/4" X 9".

4. Reinforce tops and bottoms of all doors with a continuous steel channel not less than 16 gage, extending the full width of the door and welded to both face sheets. Doors with an inverted top channel shall have a steel closure channel welded in place so the web of the channel is flush with the top of the face sheets of the door. Plastic fillers are NOT acceptable.

C. All doors to be fully insulated with 1½" thick insulation. Door Cores shall comply with SDI standards and shall be resin-impregnated kraft/paper honeycomb, polyurethane, polystyrene or rigid mineral-fiber board. Door interior shall be completely filled with core which is chemically bonded to all interior surfaces with a minimum insulation value of R10.

D. Doors shall have not less than 20 gage vertical steel stiffeners spanning the full thickness of the interior space between door faces. Stiffeners shall be spaced not more than 6" apart, and securely attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners shall be filled with fiberglass insulation (minimum density 0.8# / cubic ft.)

E. Flush type, exterior construction, 1-3/4" thick, stile 5-1/2" wide.

F. Smooth, seamless face panels formed of 16 gauge cold-rolled sheets; joined at unexposed door edges with continuous welding, full height of door. NOTE: Door fabrication shall take into account that doors will be painted under Specification Section 09900 utilizing enamel paint.

G. Accurate hardware mortising, drilling, tapping, cutouts and reinforcements for specified hardware; continuous 18 gauge channel reinforcement extending full height of door at lock and hinge edges, securely welded to both face panels.

H. Hollow metal doors shall be reinforced to prevent collapsing when closers or exit devices are attached by through-bolting or sex bolts.

I. Glass openings shall be properly reinforced, shall have 18 gauge fixed stops, mitered and welded into frames. Loose stops should be secured in place with Phillips head machine screws.

J. Provide manufacturer's standard glass lite kits with moldings to accommodate glass thickness and size of vision lite indicated. Glass lite kits to be provided with manufacturer's standard shop coat paint finish and be prepared for field finish painting. Paint frames to match door color.

K. Use standard continuous astragal at double doors. Close top of exterior doors, invert top channel, and seal top.

L. Provide construction numbers required to meet label requirements. Provide U.L. label on door; see drawings and details for label requirements.

M. Glazing as specified in Section 08800 - Glass and Glazing.

2.04 DOOR LOUVERS

A. Provide louvers for doors where indicated on the door schedule. Louvers shall comply with SDI 111C, with blades or baffles formed of 0.020 inch thick, cold-rolled steel sheet set into 0.032 inch thick steel frame.

B. Louvers shall be stationary, sightproof and constructed with inverted “V” shaped ot “Y” shaped blades.

2.05 HOLLOW METAL FRAMES

A. All EXTERIOR frames to be 12 gage hot dipped zinc coated steel that complies with ASTM designations ASTM A924 and A653.

B. All frames are to be assembled so that the face miter seam is “closed and tight”. Weld the face seam and the full web of the frame corner or intersection. Grind and dress smooth the weld area. Apply a zinc rich primer over the grinding area, and finish with a matching prime paint.

C. Materials for all other frames shall be:

1. 16 gauge for openings 3’-8” wide or less
2. 14 gauge for openings over 3’-8” wide

and that complies with ASTM A366 or A620. All Frames are to be continuous type pressed steel of the design and section shown and assembled so that the face miter seam is closed and tight. Weld the face miter seam. Grind and dress smooth the weld, finish with a matching prime paint.

D. Head to jamb corners shall be machine mitered and full throat welded (faces mitered, stops butted) back of butted stops, etc. shall be filled with sealant, joint tooled, and struck off smooth prior to painting.

E. Temporary channel or angle spreaders shall be tack welded to the bottom of frames to prevent distortion in shipment and storage and shall hold the frame in proper position until adjacent construction has been completed.

F. Bottoms of frames shall have 12 gauge adjustable floor clips punched for two 1/4” expansion bolts.

G. Provisions shall be made for installation of door silencers furnished under Finish Hardware.

H. Provide 45-minute, 60-minute, 90-minute, 3-hour, etc. doors and frames as indicated on the door schedule and as required to maintain ratings of firewall construction. All frames, including backside, reinforcement, and anchors shall be cleaned, bonderized, and prime coated.

I. Provide steel frames for doors, transoms, side lite, borrowed lite, and other openings to the size and design as shown on the architectural drawings.

J. All finished work shall be strong and rigid, neat in appearance square, true and free of defects.

K. Jamb depths, trim, profile and backbends shall be as scheduled and shown on approved shop drawings.

L. When shipping limitations so dictate, frames for large openings shall be fabricated in sections designed for splicing or splining in the field by others.

M. Hardware reinforcements are to be in accordance with the minimum standard gages as listed in SDI-100.

O. Frames shall be mortised, reinforced, drilled and tapped at the factory for only template mortised hardware, in accordance with approved hardware schedule and template provided by the hardware contractor. Where surface mounted hardware is to be applied, frames to have reinforcing plates only; drilling and tapping by others.

2.06 ANCHORS

A. Anchors for masonry rough walls shall be underwriter type 2½" wide x 10" long corrugated or perforated. Anchors for other walls shall be "Z" type or as required by the partitions and structural conditions.

B. Frames to 7'-0" high shall have three (3) anchors per jamb. Frames over 7'-0" high shall have one additional anchor for each 2'-6" or fraction thereof excess height.

C. Floor anchors shall be provided at each jamb.

D. Anchors for stud partitions will be steel of a suitable design, not less than 18 gauge thickness.

E. Dust boxes/mortar guards to be no less than 26 gage.

F. All frames that are to be welded will be provided with a steel spreader temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not be used to size the frame opening.

G. Loose glazing stops are to be 16 gage galvanized, butted at corner joints and secured to the frame with countersunk cadmium or zinc-plated screws.

H. Except on weather-stripped doors, punch stop for 3 silencers on single door and 2 silencers for double door frames.

I. Hardware reinforcement and sinkages shall be provided for the doors and frames in accordance with templates furnished by the approved hardware manufacturer. Doors and frames shall be mortised and reinforced with not less than 1/8" steel and shall be drilled and tapped to receive the specified mortised hardware.

J. Reinforcement for surface applied hardware such as closers, brackets, stops, protective plates and similar items shall provide a tapping thickness of not less than 1/8". Metal covers formed of not less than 26 gauge steel shall be provided for all mortises to prevent mortar or

plaster from filling openings and tapped holes. Plates for butt reinforcement shall be at least 8" longer than the butt and shall be not less than 3/16" thickness for tapping. The hollow metal supplier shall supply an approved set of hollow metal shop drawings for the finish hardware supplier's use when requesting hardware templates.

2.07 LABELED DOORS AND FRAMES

A. Construct and install doors and frames to comply with current issue of National Fire Protection Association (NFPA) Standard Number 80, as herein specified.

B. Doors and/or frames for labeled openings shall bear either a stamped or applied label from Warnock Hersey or Underwriters Laboratory.

C. All doors and frames are to have been tested in accordance with UL10C and UBC 7–2 Positive Pressure.

2.08 PRIME FINISH

A. Doors and frames are to be cleaned, and chemically treated to insure maximum finish paint adhesion. All surfaces of the door and frame exposed to view shall receive a factory applied coat of rust inhibiting primer. The finish shall meet the requirements for acceptance stated in ANSI A224.1 "Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces."

B. The prime finish is not intended to be the final layer of protection from the elements. Field painting using a good grade of paints shall be provided in accordance with the requirements of the painting specification.

PART 3 - EXECUTION

3.01 INSPECTION

A. It is the responsibility of the General Contractor to make sure that all dimensions for existing opening or existing frames (strike height, hinge spacing, hinge backset, etc.) given to the steel manufacturer are accurate.

B. It is the responsibility of the General Contractor to see that any scratches or disfigurements caused in shipping or handling are properly cleaned and touched up with a rust inhibitive primer.

3.02 GENERAL REQUIREMENTS AND WORKMANSHIP

A. Exposed surfaces shall be free from warp, waves, and buckles with all corners square. All members shall be set in proper alignment with all surfaces straight and in true plane. Mitered joints shall be well formed. Exposed welds shall be ground smooth and flush on exposed surfaces. Face of metal and contact shall have hairline joints.

B. Hollow metal work shall be of approved manufacturer, strong and rigid, neat in appearance, and free from defects, fabricated in accordance with the best shop practices.

C. Hollow metal doors and frames shall be of the type, thickness and dimensions shown on the drawings. Fastenings shall be concealed where practical. Construction joints shall be continuously welded their full length and ground flush on exposed surfaces. Doors shall have

proper bevel to operate without binding. Where assemblies of doors and frames occur in opening noted to be labeled, such assemblies shall conform to the label requirements of the National Fire Protection Association and shall bear the label of the Underwriters' Laboratory, Inc.

3.03 FRAME INSTALLATION

A. Prior to installation, all frames must be checked for rack, twist and out of square conditions.

B. Place frames prior to enclosing walls and ceilings. Set frames accurately in position, plumbed and braced securely until permanent anchors are set.

C. Fill frames in masonry walls with mortar.

D. When temperature conditions necessitate an additive to be used in the plaster or mortar to prevent freezing, the contractor installing the frames shall coat the inside of the frames, in the field, with a corrosion inhibiting bituminous material.

E. SDI-105, "Recommended Erection Instructions for Steel Frames" and SDI-110 "Standard Steel Doors and Frames for Modular Masonry Construction" shall indicate the proper installation procedures.

3.04 DOOR INSTALLATION

A. Install doors plumb and in true alignment in a prepared opening and fasten them to achieve the maximum operational effectiveness and appearance.

B. Proper door clearance must be maintained in accordance with SDI-110.

C. Where necessary, only metal hinge shims are acceptable to maintain clearances.

D. "Installation Guide for Doors and Hardware" published by DHI is recommended for further details.

E. Hardware must be applied in accordance with hardware manufacturer's templates and instructions.

3.05 ADJUST AND CLEAN

A. Check and re-adjust operating finish hardware items in hollow metal work just prior to final inspection. Leave work in complete and proper condition.

B. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply to touch-up or compatible air-drying primer.

3.04 SCHEDULES

A. After installation, copies of the door schedules are to be turned over to the owner when the building is accepted.

END OF SECTION 08 11 00

SECTION 08 15 13 PLASTIC LAMINATE FACED WOOD DOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Interior High-Pressure Decorative Laminate Faced Doors:

1. Flush solid-core high-pressure decorative laminate doors.
2. Flush fire-rated high-pressure decorative laminate doors.
3. Provide factory installed glass lites and wood frames
4. Sound retardant doors

1.02 REFERENCES

A. ANSI A208.1, Grade 1-LD-2 – Particleboard Extra Heavy Duty Particleboard Core.

Commented [AB1]: LD-2 is Extra Heavy Duty Particleboard – it's referenced later, but helps for clarification to call it out here too.

B. ASTM E 90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

C. ASTM E 413 – Classification for Rating Sound Insulation.

D. AWI Section 1300 – Architectural Flush Doors.

E. NEMA LD3 – High Pressure Decorative Laminates.

F. NFPA 80 – Standard for Fire Doors and Other Opening Protectives.

G. UBC 7-2-1997/UL 10C – Positive Pressure Fire Tests of Door Assemblies.

H. WDMA I.S.1-A – Architectural Wood Flush Doors.

1.03 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data, including door construction description and WDMA I.S.1-A and AWI classifications.

C. Schedules: Submit manufacturer's schedules, including door dimensions, cutouts, high-pressure decorative laminate selection, and hardware. Reference individual door numbers as indicated on the Drawings.

D. Samples:

1. Submit manufacturer's door construction samples for door model specified.
2. Submit manufacturer's sample chip with color and finish number.

E. Manufacturer's Certification: Submit manufacturer's certification that doors comply with specified requirements and are suitable for intended application.

F. Test Reports: Submit manufacturer's test results of STC rating from testing performed by independent testing agency for sound-retardant doors.

G. Environmental Documentation: Submit manufacturer's environmental documentation.

1. Forest Stewardship Council (FSC) Particleboard Core Construction: Chain of custody certificate.

2. Most are referencing FSC Particleboard Core

3. Manufacturer's Information: Describe available LEED points.

H. Cleaning Instructions: Submit manufacturer's cleaning instructions for doors.

I. Warranty: Submit manufacturer's standard warranty.

1.04 QUALITY ASSURANCE

A. Tolerances for Warp, Telegraphing, Squareness, and Prefitting Dimensions: WDMA I.S.1-A and AWI Section 1300.

B. Identifying Label: Each door shall bear identifying label indicating:

1. Door manufacturer.
2. Order number.
3. Door number.
4. Fire rating, if applicable.

C. Fire-Rated Doors: Labeled by Intertek/Warnock Hersey.

1. Construction Details and Hardware Application: Approved by labeling agency.

D. Positive Pressure Opening Assemblies: UBC 7-2-1997/UL 10C.

E. Environmental Responsibility: Provide doors manufactured with the following environmentally responsible core materials:

1. Particleboard Core: Forest Stewardship Council (FSC) certified.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Deliver doors to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

2. Package doors individually in polybags.

B. Storage:

1. Store doors in accordance with manufacturer's instructions.

2. Store doors in clean, dry area indoors, protected from damage and direct sunlight.

3. Store doors flat on level surface.

4. Do not store doors directly on concrete.

5. Keep doors completely covered. Use covering which allows air circulation and does not permit light to penetrate.

Commented [AB2]: Remove Stave Lumber and replace with "Particleboard"

Commented [AB3]: See note above about adjusting the text to Particleboard

Commented [AB4]: Adjust to Particleboard and remove the Agrifiber Core

6. Store doors between 50 and 90 degrees F (10 and 32 degrees C) and 25 to 55 percent relative humidity.

C. Handling:

1. Handle doors in accordance with manufacturer's instructions.

2. Protect doors and finish during handling and installation to prevent damage.

3. Handle doors with clean hands or clean gloves.

4. Lift and carry doors. Do not drag doors across other doors or surfaces.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Do not subject doors to extreme conditions or changes in temperature or relative humidity in accordance with WDMA I.S.1-A.

1.07 WARRANTY

A. Warrant solid core, interior doors for life of installation against warpage, delamination, and defects in materials and workmanship.

B. Defects noted during warranty period shall be corrected at no cost to Owner. Corrective work shall include labor and material for repair, replacement, refinishing, and rehanging as required.

PART 2 - PRODUCTS

2.01 MANUFACTURER - WOOD DOORS

A. ~~A. Basis of Design – Masonite Architectural Aspiro Series – www.masonite.com/architectural~~

B. Substitutions: Refer to section 01 25 13. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. VT Industries, Inc., www.vtindustries.com.
2. Oshkosh Architectural Door Co., www.oshkoshdoor.com

B. Plastic Laminate: Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Wilsonart International
2. Nevamar Corp.
3. Pionite Decorative Surfaces
4. Formica Corp.

2.02 MANUFACTURER - METAL DOOR LOUVERS FOR WOOD DOORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Air Louvers, Inc., www.airlouvers.com
2. Anemostat Door Products, www.anemostat.com
3. Leslie-Locke, Inc.

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Commented [AB5]: Adjust listing of manufacturers Algoma, Graham, Marshfield and Mohawk are under Masonite Architectural.
Eggers is under VT now.

Can also list this section as substitutions need to be approved by architect before bid.

Commented [AB6]: Please include color name and finish code for recommendation to provide most accurate pricing for distributors

2.03 MANUFACTURER - ACOUSTICAL GASKETING FOR WOOD DOORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Zero International, www.zerointernational.com
2. Door Hardware Systems, Inc. www.dhsi-seal.com
3. Pemko Manufacturing Co., www.pemko.com
4. Acoustical Surfaces, Inc. www.acousticalsurfaces.com
5. Unger Technologies, Inc., www.enoisecontrol.com

B. Install head, jamb and door bottom seals on all doors as noted on the drawings and schedule.

C. Acoustical Seal Types (Refer to door schedule for locations)

1. Head and jamb seals: Equal to Zero #170, Unger #365, Acoustical Surfaces #599C-HD or approved equal.

2. Automatic Door Bottom: Equal to Zero #360, Acoustical Surfaces #330C - HD, Unger #365 or approved equal

Commented [AB7]: If you have a particular STC rating you are going for, please contact Masonite Architectural rep to review the seals that have been tested to make sure we are specifying the correct gasketing/seals.

2.04 GENERAL

A. High-Pressure Decorative Laminates: NEMA LD3.

1. Face laminate doors, .050" General Purpose HPDL.
2. Nominal Minimum Thickness for Faces and Vertical Edges: 0.048 inch.
3. Laminate Selection: Standard products of Formica, Nevamar, Pionite, Wilsonart, or equal.
4. Finish: Manufacturer's standard.
5. Grade: General purpose, horizontal grade.

B. Glass Lite Frame: Manufacturer's standard wood moulding frame, stain or paint finish to match laminate. Color to be selected by architect.

C. Factory Installed Glazing: ¼" non-insulated or 1" insulated as required, tempered glass or otherwise as specified in Section 08 80 00.

Commented [AB8]: Good information to note here, also include in the glazing section to not have 2 trades bidding the same info.

D. Factory Installed Non-rated Door Louvers: Vision proof, inverted Y" blade, extruded aluminum with Class II, color anodic finish complying with AA-C22A32/A34.

E. Factory Installed Rated Door Louvers: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire rating of 1-1/2 hours or less. Galvanized steel, 1.0 mm thick, hot-dipped coated and factory primed for paint finish.

2.04 FLUSH SOLID-CORE HIGH-PRESSURE DECORATIVE LAMINATE DOORS

A. UF Free Particleboard core, non-rated and 20-minute rated. Provide SCL core as required by lite or louver openings to maintain manufacturers door warranty and comply with WDMA requirements.

B. Compliance: WDMA I.S.1-A.

1. Quality Grade: Premium grade, extra heavy duty.
2. Type: PC-HPDL-5 .

Commented [AB9]: Good to note! Some may not be aware that LD-2 is extra heavy duty particleboard.

C. 7-Ply and Non-Bonded Core Construction: Not acceptable.

D. Door Thickness: 1-3/4 inches.

E. Stiles:

1. 1-3/8 inches wide, before prefitting.
2. Structural composite lumber (SCL).
3. High pressure face laminate before edges.
4. Vertical Edges to be 3mm Impact Edge applied after face and to be corresponding industry match

F. Rails:

1. Structural composite lumber (SCL).
2. Minimum Width Before Prefitting: 1-3/8 inches.

G. Core Material: UF Free PBC Core

H. Door Assembly:

1. Glue stiles and rails to core.
2. Monolithically sand core assembly to ensure minimum telegraphing of core components.

I. Laminates:

1. Apply to core in hot press using Type I, exterior, water-resistant adhesive.
2. 5-ply construction.

2.05 FLUSH FIRE-RATED HIGH-PRESSURE DECORATIVE LAMINATE DOORS

A. Rating: 45-minute rated, 60-minute rated, and 90 minute rated as required by door schedule.

B. Compliance: WDMA I.S.1-A.

1. Quality Grade: WDMA – Extra Heavy Duty Particleboard
2. Type: FD-HPDL-5

C. Door Thickness: 1-3/4 inches.

D. Inner Stiles:

1. Supply the noncombustible stile material for 45-, 60, and 90- minute rated as required.
2. Warranted for use with standard-weight mortise butt hinges and No. 12, 1-1/4-inch steel threaded-to-head screws.

F. Rails:

1. Supply the noncombustible material for 45-, 60-, and 90- minute rated as required.
2. Width: Manufacturer's standard width.

G. Core:
1. Fire-retardant material

Commented [AB10]: This compliments the Impact Edge we will reference in the edges section. Situations where abuse or high traffic areas we would recommend the impact edge, which is applied after the face. I will attach some information regarding this in the email.

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2. No added urea formaldehyde.

Commented [AB14]: Adjust text here.

H. Composite Crossbands:

1. Apply to core before application of matching hardware stiles.
2. Exposed Crossbanding: Not allowed along stile edges.

J. Positive Pressure:

1. Where UBC 7-2-1997/UL 10C standards for positive pressure apply, doors shall be constructed in accordance with Category A guidelines as published by Intertek/Warnock Hersey.

2. Smoke Gasketing: Apply smoke gasketing around frame perimeter to meet S-rating.

3. Intertek/Warnock Hersey Category B Guidelines: Edge sealing systems not allowed on frames.

K. Electronic Barcode: Provide labeling or barcode to facilitate Owner's inspection as required by NFPA 80.

1. Location: Fire label, hinge stile of doors.

2. Provide fire-rated door assembly information required for Owner's annual fire-door inspection in accordance with NFPA 80, Paragraph 5.2.1.

Commented [AB15]: Are you specifying this and utilizing this? If so, where and how? If not, this can be removed.
We have a different option for this.

2.06 SOUND RETARDANT DOORS

A. Sound-Retardant Doors:

1. Stained stiles.
2. Compliance: WDMA I.S.1-A.
3. Quality Grade: Premium.
4. Testing Methods: ASTM E 90 and E 413.
5. Door Thickness: 1-3/4 inches.
6. STC Rating: 41, 20-minute fire rated, 45, non-fire rated.
7. Core: Sound absorbent material encapsulated by stiles, rails, crossbands, and face laminates.

8. Perimeter Gasketing and Drop Seals: To achieve STC ratings.

9. High-Pressure Decorative Laminate Faces: Identical with non-rated and fire-rated doors.

10. Vertical Stile Edges: Painted or stained to complement faces.

11. Provide Acoustical Lite Kit per manufacturer's standard

2.07 FABRICATION

A. Vertical Edges to be 3mm Impact Edge applied after face and to be corresponding industry match

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B. Prefit Doors:

1. Prefit and bevel doors at factory to fit openings.

2. Prefit Tolerances: WDMA I.S.1-A.

C. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts.

D. Top and Bottom Rails: Clean Edge (or prepare top and bottom rails to meet manufacturer's lifetime warranty.)

Commented [AB16]: This information is also in the PDF on Impact/Clean edges. This seals the top and bottom with a clean edge – better for cleaning chemicals and equipment that may hit the door.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine locations to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not begin installation until unacceptable conditions are corrected.

B. Ensure frames are solidly anchored, allowing no deflection when doors are installed.

C. Ensure frames are plumb, level, square, and within tolerance.

3.02 PREPARATION

A. Allow doors to become acclimated to building temperature and relative humidity for a minimum of 24 hours before installation.

3.03 INSTALLATION

A. Install doors in accordance with manufacturer's instructions.

B. Install doors at locations indicated on the Drawings and Door Schedule.

C. Install doors plumb, level, square, true to line, without warp or rack.

D. Seal exposed surfaces with a minimum of 2 coats of polyurethane within 4 days of fitting each door.

E. Install door hardware as specified in Section 08 71 00.

3.04 ADJUSTING

A. Adjust doors to swing freely, without binding in frame.

B. Adjust hardware to operate properly.

C. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by Architect.

D. Remove and replace damaged doors that cannot be successfully repaired, as determined by Architect.

3.05 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.06 PROTECTION

A. Protect installed doors from damage during construction.
B. Place polybags over doors after adjusting and cleaning.

END OF SECTION 08 15 13

SECTION 08 31 13 ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes fire resistive rated and non-rated access doors and panels with frames.

1. Provide for access to controls, valves, traps, dampers, cleanouts, and similar items requiring operation behind inaccessible finished surfaces.

2. Coordinate exact locations with various trades to assure proper placement of access doors and panels.

1.02 REFERENCES

A. ASTM International: ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

B. Intertek Testing Services (Warnock Hersey Listed): WH - Certification Listings.

C. National Fire Protection Association: NFPA 80 - Standard for Fire Doors, Fire Windows.

1.03 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: indicate exact position of access door units.

C. Product Data: Submit literature indicating sizes, types, finishes, hardware, scheduled locations, fire resistance listings, and details of adjoining Work.

D. Manufacturer's Installation Instructions: Submit installation requirements and rough-in dimensions.

1.04 QUALITY ASSURANCE

A. Fire Resistance Ratings: Where indicated as fire rated provide assemblies from manufacturers listed in UL Directory or Intertek Testing Services (Warnock Hersey Listed) Directory.

B. Fire Rated Access Doors: Rating as indicated on Drawings. Tested Rating: Determined in accordance with ASTM E119.

C. Attach label from agency approved by authority having jurisdiction to identify each fire rated access door.

1.05 COORDINATION

A. Coordinate Work with work requiring controls, valves, traps, dampers, cleanouts, and similar items requiring operation being located behind finished surfaces.

PART 2 - PRODUCTS

2.01 ACCESS DOORS AND PANELS

A. Manufacturers:

1. J. L. Industries.
2. Karp Associates, Inc.
3. Milcor LTD, Partnership.
4. Nystrom Products Co.
5. Bilco Co.
6. Acudor Products, Inc.
7. **Babcock-Davis Co.**
8. Alfab, Inc. – Bar-Co Access Doors
9. Larsen's Manufacturing Co.
10. The Williams Brothers Corp.
11. Substitutions: Section 01 25 13 - Product Substitution Procedures

B. Access Doors in all exterior or non-conditioned spaces: Provide ANODIZED aluminum access doors of same type and gauge as steel access doors.

C. Flush Framed Access Doors: Frames and nominal 1 inch wide exposed flanges of 16 gage steel and door panels of 14 gage steel.

D. Gypsum Board Access Doors: Frames and nominal 1 inch wide flanges of 16 gage steel and door panels of 14 gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09 21 16.

E. Plaster Access Doors: Frames and nominal 1 inch wide flanges of 16 gage steel and door panels of 14 gage steel. Design flanges to be concealed by plaster specified in Section 09225.

F. Fire Rated Access Doors: Frames and nominal 1 inch wide exposed flanges of minimum 16 gage steel and door panels of 20 gage steel. Provide self closing and latching doors with keyed lock.

G. Gypsum Board Fire Rated Access Doors: 16 gage steel frames with minimum 22 gage galvanized steel drywall bead flanges and door panels of 20 gage steel. Design flanges to be concealed by gypsum board joint finishing compound specified in Section 09211. Provide self closing and latching doors with keyed lock.

H. Floor Access Doors (locate as indicated on the drawings): min. 30" x 36" clear access size, single leaf, extruded aluminum frame with ¼" aluminum diamond pattern plate for concealed areas. Bilco Model K-3 or approved equal. For VCT or carpet areas provide Bilco Model T-3 or approved equal.

2.02 PRODUCTS

A. General: The following access panel types are for selection as required whether or not indicated on drawings, unless indicated elsewhere in Division 15 or Division 16. The contractor shall evaluate the specific requirements and provide the appropriate system based on the condition, as all types may not be required on the project. The inclusion of any of the listed access panel types does not necessarily imply that the condition exists in the scope of work.

1. Specification based on products of Babcock-Davis Company.

2. Access doors located in exterior locations to have an intrusion alarm. Coordinate with Division 28.

B. FLUSH STEEL DOOR FOR EXTERIOR MASONRY CONSTRUCTION:

1. Size: 2'-0" X 3'-0" inches unless otherwise noted in drawings or specifications.
2. Hinges: Stainless steel concealed continuous piano type hinges.
3. Frames: 6063-T5 extruded aluminum frame. Mill finish
4. Doors: 20 gauge galvanized steel. Phosphate dipped and prime coated for field painting per Section 09 90 00.
5. Latch and Lock: Two (2) dual acting handles with exterior lock.
6. Gasketing: Extruded santoprene
7. Insulation: 2 inch thick fiberglass
8. Approved Product: Model "B-XT". or Architect approved equal.

C. FLUSH STEEL DOOR FOR WALLBOARD AND MASONRY CONSTRUCTION:

1. Size: 2'-0" X 3'-0" unless otherwise noted in drawings or specifications.

   a. Provide 12 inch x 12 inch access panels at all motorized overhead coiling doors, grilles, and coiling counter doors that are located within non-removable ceilings for access to motors for repairs and maintenance of electric operators.
2. Hinges: Concealed continuous piano type hinges.
3. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00.
4. Frames: 16 gauge galvanized steel with 22 gauge galvanized wallboard corner bead
5. Doors: 14 gauge galvanized steel.
6. Lock: Flush screw driver operated cam.
7. Approved Product: Model "B-NW", or Architect approved equal.

D. FLUSH STEEL DOOR FOR PLASTER/STUCCO SOFFIT CONSTRUCTION:

1. Size: As shown on the drawings.
2. Hinges: Concealed continuous piano type hinges.
3. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00.
4. Frames: 16 gauge galvanized steel with 22 gauge galvanized plaster casing bead
5. Doors: 14 gauge galvanized steel.
6. Lock: Flush screw driver operated cam.
7. Approved Product: Model "B-NP", or Architect approved equal.

E. FIRE RATED FLUSH STEEL DOOR FOR WALLBOARD CONSTRUCTION:

1. Listing: UL listed 'B' label up to 1-1/2 hours in walls and Warnock-Hershey listed up to 3 hours in ceilings.
2. Size: As shown on the drawings.
3. Hinges: Concealed pin hinge
4. Finish: Phosphate dipped and prime coated for field painting per Section 09 90 00.
5. Frames: 16 gauge galvanized steel with 22 gauge galvanized wallboard corner bead
6. Doors: 20 gauge galvanized steel.
7. Lock: Knurled knob/key operated latch bolt.
8. Insulation: 2 inch thick fire rated mineral fiber
9. Approved Product: Model "B-IW", or Architect approved equal.

F. INSULATED ACCESS PANEL FOR VALVE BOX IN EXTERIOR BRICK WALL:

1. Size: 12 inches x 12 inches, or as required for application.
2. Door: 0.060 6063-T5 extruded aluminum.
3. Frame: 0.060 6063-T5 extruded aluminum.
4. Hinge: Stainless steel concealed piano hinge.
5. Latch: Hex head cam latch operable with standard allen wrench.
6. Finish: Paint grip.
7. Insulation: Two (2) inch thick fiberglass.
8. Gasket: Extruded Sanoprene.
9. Approved Product: Model "B-XT", or Architect approved equal.

2.03 FABRICATION

A. Fabricate units of continuous welded construction; weld, fill, and grind joints to assure flush and square unit.

B. Wall and Ceiling Access Door and Panel Hardware:

1. Hinge: Standard concealed spring pin type, 175 degree steel hinges.

2. Lock: Self-latching lock. Screw driver slot for quarter turn cam lock.

C. Size Variations: Obtain acceptance of manufacturer's standard size units which vary slightly from sizes shown or scheduled.

2.04 SHOP FINISHING

A. Base Metal Protection: Galvanized, hot dipped wiped coat finish.

B. Finish: One coat baked enamel, color as selected.

C. Aluminum Doors (for exterior or non-conditioned locations only): Clear anodized finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01300 - Administrative Requirements: Coordination and project conditions.

B. Verify rough openings for access doors and panels are correctly sized and located.

3.02 LOCATIONS

A. Provide where required by code and where needed to service and maintain equipment.

B. If not shown on the drawings, consult the Architect before locating in finished spaces.

3.03 INSTALLATION

A. Secure frames rigidly in place, plumb and level in opening, with plane of door and panel face aligned with adjacent finished surfaces.

1. Set concealed frame type units flush with adjacent finished surfaces.

B. Position unit to provide convenient access to concealed work requiring access,

C. Install fire rated units in accordance with NFPA 80 and requirements for fire listing.

END OF SECTION 08 31 00

SECTION 08 33 00 ROLLING GRILLES

PART 1 GENERAL

1.1 SUMMARY

A. **Section Includes:** electric operated overhead rolling grilles.

1.2 SUBMITTALS

A. **Reference Section 01 33 00 Submittal Procedures; submit the following items:**
1. **Product Data.**
2. **Shop Drawings:** Include special conditions not detailed in Product Data. Show interface with adjacent work.
3. **Quality Assurance/Control Submittals:**
a. Provide proof of manufacturer ISO 9001:2015 registration.
b. Provide proof of manufacturer and installer qualifications - see 1.3 below.
c. Provide manufacturer's installation instructions.
4. **Closeout Submittals:**
a. Operation and Maintenance Manual.
b. Certificate stating that installed materials comply with this specification.

1.4 QUALITY ASSURANCE

A. **Qualifications:**
1. **Manufacturer Qualifications:** ISO 9001:2015 registered and a minimum of five years experience in producing grilles of the type specified.
2. **Installer Qualifications:** Manufacturer's approval.

1.5 DELIVERY STORAGE AND HANDLING

A. Follow manufacturer's instructions.

1.6 WARRANTY

A. **Standard Warranty:** Two years from date of shipment against defects in material and workmanship.

B. **Maintenance:** Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. **Manufacturer:**
1. **Cornell:** 24 Elmwood Avenue, Mountain Top, PA 18707. Telephone: (800) 233-8366.
2. **Cookson**
3. **Clopay Building Products**

B. **Model:** ESG10

C. **Substitutions:** Reference Section 01 25 13

2.2 MATERIALS

A. **Curtain:**

1. **ESG10 Straight Pattern**

a. **Horizontal Rods:** Solid [5/16 inch (8 mm) diameter, 5056 H32 aluminum alloy] [5/16 inch (8 mm) diameter, AISI 300 series stainless steel] [5/16 inch (8 mm) diameter galvanized steel].

1. **Vertical Spacing:** 2 inches (50.8 mm) on center.

b. **Vertical Chains:** Grommetted aluminum links, 3/4 inch (19 mm) wide, positioned by E-rings on 3 inch (76.2 mm) centers. Provide double E-rings on horizontal bars on both sides of end chains to retain curtain in guides.

1. **Bottom Bar:** 2 x 3-1/2 inch (50.8 x 88.9 mm) extruded aluminum tubular section reinforced with 3 x2 x 3/16 inch (76.2 x 50.8 x 4.76 mm) aluminum angle(s).

2. **Finish:**

a. **Aluminum Curtain and Bottom Bar:**

1. **Curtain:** Clear anodized.
2. **Bottom Bar:** Clear anodized.

B. **Guides, Tube Mounted:** Heavy duty extruded aluminum sections with snap-on cover to conceal fasteners and polypropylene pile runners on both sides of curtain. Provide aluminum tubes, floor saddles and hardware as recommended by manufacturer to support grille.

1. **Finish, Aluminum Guide Components:**

a. Clear anodized

2. **Finish, Steel** Tubes:

a. Zirconium treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

C. **Counterbalance Shaft Assembly:**

1. **Barrel:** Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width.
2. **Spring Balance:** Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of grille to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque.

D. **Brackets:** Fabricate from minimum 3/16 inch (4.76 mm) steel plate with permanently lubricated ball or roller bearings at rotating support points to support counterbalance shaft assembly and form end closures.

1. **Finish:**

a. Zirconium treatment followed by a light gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

a. Zirconium treatment followed by a corrosion inhibitive baked-on zinc-rich gray polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness.

a. ASTM A 123, Grade 85 zinc coating, hot-dip galvanized after fabrication.

E. **Hood and Fascia:** 24 gauge galvanized steel with reinforced top and bottom edges. Provide minimum 1/4 inch (6.35 mm) steel intermediate support brackets as required to prevent excessive sag.

1. **Finish:**

a. **GalvaNex Coating System** to include an ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation of a chemical bonding, light gray baked-on polyester base coat and a light gray baked-on polyester enamel finish coat. The scientific organic material composition and chemical bonding process of GalvaNex produces a superior finish against corrosion and abrasion. GalvaNex components include a limited two year finish warranty.

2.3 ACCESSORIES

A. **Locking:**
1. **Motor Operated:** Keyed cylinder locking into both jambs operable from both sides of curtain with motor interlock cutout switches.

B. **Emergency Egress System:** Provide wall mounted manual release system pull handle to disengage motor operator and automatically open grille for emergency egress without the use of electrical power. Release of pull handle will reset grille to normal motor operation.

C. **Operator and Bracket Mechanism Cover:** Provide 24 gauge galvanized steel sheet metal cover to enclose exposed moving operating components at coil area of unit. Finish to match door hood.

2.4 OPERATION

A. **Supply Model MG Electric Motor Operator, industrial duty** - rated for a maximum of 20 cycles per hour, cULus listed, Totally Enclosed Non Ventilated gear head operator(s) rated (1/3) (1/2) or (3/4) hp as recommended by door manufacture for size and type of door. Provide complete with electric motor and factory pre-wired motor control terminals, maintenance free solenoid actuated brake, emergency manual chain hoist and control station(s). Motor shall be high starting torque, industrial type, protected against overload with an auto-reset thermal sensing device. Primary speed reduction shall be heavy-duty, lubricated gears with mechanical braking to hold the door in any position. Operator shall be equipped with an emergency manual chain hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual chain hoist. Operator drive and door driven sprockets shall be provided with #50 roller chain. Provide an integral Motor Mounted Interlock system to prevent damage to door and operator when mechanical door locking devices are provided. Operator shall be capable of driving the door at a speed of 6 to 9 inches per second (15 to 23 cm/sec). Fully adjustable, driven linear screw type cam limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station(s) and supply the appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

1. **Control Station:** Flush mounted, "Open/Close" key switch with "Stop" push button; NEMA 1B.

B. Provide operator to function with constant pressure close operation to meet UL325-2010 listing standard requirements.

C. **Sensing/Weather Edge:** Provide automatic reversing control by an automatic sensing switch within neoprene or rubber astragal extending full width of grille bottom bar.
1. Provide an electric sensing edge device. Contact before grille fully closes shall cause door to immediately stop downward travel and reverse direction to the fully opened position. Provide a wireless sensing edge connection to motor operator eliminating the need for a physical traveling electric cord connection between bottom bar sensing edge device and motor operator.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings.

B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates.

C. Commencement of work by installer is acceptance of substrate.

3.2 INSTALLATION

A. General: Install grille and operating equipment with necessary hardware, anchors, inserts, hangers and supports.

B. Follow manufacturer's installation instructions.

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust grilles for ease of operation, free from warp, twist, or distortion.

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer.

B. Remove surplus materials and debris from the site.

3.5 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative.

B. Instruct Owner's Representative in maintenance procedures.

END OF SECTION

SECTION 08 33 02 ROLLING COUNTER SHUTTERS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: manual rolling counter doors

B. Related Sections:
1. Division 05 Metal Fabrications. Door opening jamb and head members
2. Division 06 Rough Carpentry. Door opening jamb and head members
3. Division 08 Access Doors and Panels. Access doors
4. Division 09 Painting. Field painting
5. Division 26. Electrical wiring and conduit, fuses, disconnect switches, connection of operator to power supply, and installation of control station and wiring.

1.2 SUBMITTALS

A. Reference Division 01 Submittal Procedures; submit the following items:
1. Product Data
2. Shop Drawings: Include special conditions not detailed in Product Data. Show interface with adjacent work.
3. Quality Assurance/Control Submittals:
a. Provide manufacturer ISO 9001:2015 registration
b. Provide manufacturer and installer qualifications - see below
c. Provide manufacturer's installation instructions
4. Closeout Submittals:
a. Operation and Maintenance Manual
b. Certificate stating that installed materials comply with this specification

1.3 QUALITY ASSURANCE
A. Qualifications:
1. Manufacturer Qualifications: ISO 9001:2015 registered and a minimum of five years experience in producing counter doors of the type specified
2. Installer Qualifications: Manufacturer’s approval

1.4 DELIVERY STORAGE AND HANDLING

A. Reference Section 01 66 00 Product Storage and Handling Requirements.
B. Follow manufacturer’s instructions.

1.5 WARRANTY

A. Standard Warranty: Two years from date of shipment against defects in material and workmanship
B. Maintenance: Submit for owner’s consideration and acceptance of a maintenance service agreement for installed products.

PART 2 PRODUCTS

2.1 MANUFACTURER
A. Manufacturer:
Cornell: 24 Elmwood Avenue, Mountain Top, PA 18707. Telephone: (800) 233-836

B. Alternates:
1. Cookson
2. Clopay Building Products

2.2 PRODUCT INFORMATION
A. Model: ESC10

2.3 MATERIALS
A. Curtain:
a. Aluminum: No. 1F, interlocked flat-faced slats, 1-1/2 inches (38 mm) high by 1/2 inch (13 mm) deep, minimum 0.040 inch aluminum with extruded tubular aluminum bottom bar with continuous lift handle and vinyl astragal
2. Finish:
a. Aluminum: Clear anodized

B. Endlocks:
Fabricate interlocking slat sections with high strength molded nylon endlocks riveted to ends of alternate slats

C. Guides:
1. Fabrication:
a. Aluminum: Heavy duty extruded aluminum sections with snap-on cover to conceal fasteners. Provide polypropylene pile runners on both sides of curtain to eliminate metal to metal contact between guides and curtain.
2. Finish:
a. Aluminum: Clear anodized

D. Shaft Assembly:
1. Counterbalance Shaft Assembly:
a. Barrel: Steel pipe capable of supporting curtain load with maximum deflection of 0.03 inches per foot (2.5 mm per meter) of width
b. Spring Balance: Oil-tempered, heat-treated steel helical torsion spring assembly designed for proper balance of door to ensure that maximum effort to operate will not exceed 25 lbs (110 N). Provide wheel for applying and adjusting spring torque

E. Brackets:
Fabricate from reinforced steel plate with bearings at rotating support points to support counterbalance shaft assembly and form end closures
1. Finish:
a. Standard (Stock Color): Zirconium treatment followed by a gray baked-on polyester powder coat; minimum 2.5 mils (0.065 mm) cured film thickness

F. Hood:
Minimum .040 aluminum with reinforced top and bottom edges.
1. Finish:
a. Aluminum: Clear anodized

2.4 OPERATION
A. Motorized
1. Electric Tube Motor Operator: Rated for a maximum of 10 cycles per day, cULus recognized, rated (50nm) (100nm) or (200nm) as recommended by door manufacturer for size and type of door, 120 Volts, 1 Phase. Provide complete with electric tube motor, maintenance free electric brake, emergency manual crank hoist and control station(s). Motor shall be protected against overload with an auto-reset thermal sensing device. Operator shall be equipped with an emergency manual crank hoist assembly that safely cuts operator power when engaged. A disconnect chain shall not be required to engage or release the manual crank hoist. Operator shall be capable of 10-14 RPM. Fully adjustable, mechanical internal worm limit switch mechanism shall synchronize the operator with the door. The electrical contractor shall mount the control station(s) and supply the

appropriate disconnect switch, all conduit and wiring per the overhead door wiring instructions.

B. Control Station: For use with motor operated units only
   1. Flush mounted: Rocker Switch; NEMA 1

C. Control Operation:
   1. Constant pressure to close:
      a. No sensing device required

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates upon which work will be installed and verify conditions are in accordance with approved shop drawings
B. Coordinate with responsible entity to perform corrective work on unsatisfactory substrates
C. Commencement of work by installer is acceptance of substrate

3.2 INSTALLATION

A. Install door and operating equipment with necessary hardware, anchors, inserts, hangers and supports
B. Follow manufacturer's installation instructions

3.3 ADJUSTING

A. Following completion of installation, including related work by others, lubricate, test, and adjust doors for ease of operation, free from warp, twist, or distortion

3.4 CLEANING

A. Clean surfaces soiled by work as recommended by manufacturer
B. Remove surplus materials and debris from the site

3.5 DEMONSTRATION

A. Demonstrate proper operation to Owner's Representative
B. Instruct Owner's Representative in maintenance procedures

3.6 SCHEDULE

A. Door Number:
   1. C209B

END OF SECTION

SECTION 08 41 13 ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section covers Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.

1.3 DEFINITIONS

A. For fenestration industry standard terminology and definitions, refer to the Fenestration & Glazing Industry Alliance (FGIA) Glossary (AAMA AG-13).

1.4 PERFORMANCE REQUIREMENTS

A. General Performance:
1. Product to comply with the specified performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction, as determined by testing of aluminum storefront systems representing those indicated for this project.
2. Aluminum storefront systems shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
3. Failure includes any of these events:
   a. Thermal stresses transferring to building structure
   b. Glass breakage
   c. Loosening or weakening of fasteners, attachments, and other components
   d. Failure of operating units

B. Delegated Design:
1. Design aluminum storefront systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind Loads: Provide storefront system; include anchorage, capable of withstanding wind load design pressures as indicated in the drawings.

D. Air Leakage:
1. The test specimen shall be tested in accordance with ASTM E 283.
2. With interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.2 psf (300 Pa).

3. Without interior seal, air leakage rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 1.6 psf (75 Pa).
4. CSA A440 Fixed Rating

E. Water Resistance:
1. The test specimen shall be tested in accordance with ASTM E 331.
2. There shall be no leakage at a minimum static air pressure differential of 15 psf (720 Pa) as defined in AAMA 501.
3. CSA A440 B5 Rating

F. Uniform Load:
1. A static air design load of 30 psf (1436 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330.
2. There shall be no deflection in excess of L/175 of the span of any framing member.
3. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
4. CSA A440 C2 Rating

G. Thermal Transmittance (U-factor):
1. Thermal transmittance test results are based upon 1" (25.4 mm) clear high-performance insulating glass [1/4" (e=0.035, #2), 1/2" warm edge spacer and argon fill gas, 1/4"].

H. Sound Transmission Class (STC) and Outdoor-Indoor Transmission Class (OITC):
1. Sound transmission loss test results in accordance with AAMA 1801 are based upon 1" (25.4 mm) clear double laminated insulating glass with PVB interlayer (1/8", 0.030", 1/8", 1/2" AS, 1/8", 0.030", 1/8").
2. Ratings shall not be less than listed here:
a. Trifab® VersaGlaze® 601/601T/601UT Framing System, Center Plane laminated glass STC 37 and OITC 31

I. Impact Resistance Performance(Center Plane Only):
1. The test specimen shall be tested in accordance with ASTM E 1886, information in ASTM E 1996 and TAS 201/203.
2. Large-Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.

1.5 SUBMITTALS

A. Product Data:
1. For each type of aluminum-framed storefront system indicated, include:
a. Construction details
b. Material descriptions
c. Dimensions of individual components and profiles
d. Hardware
e. Finishes
f. Installation instructions

B. Shop Drawings:
   1. Plans
   2. Elevations
   3. Sections
   4. Details
   5. Hardware
   6. Attachments to other work
   7. Operational clearances
   8. Installation details

C. Samples for Initial Selection:
   1. Provide samples for units with factory-applied color finishes.
   2. Provide samples of hardware and accessories involving color selection.

D. Samples for Verification:
   1. Provide a verification sample for aluminum-framed storefront system and required components.

E. Product Test Reports:
   1. Provide test reports for each type of aluminum-framed storefront used in the project.
   2. Test reports must be based on evaluation of comprehensive tests performed by a qualified preconstruction testing agency.
   3. Test reports must indicate compliance with performance requirements.

F. Fabrication Sample:
   1. Provide a fabrication sample of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
      a. Joinery, including concealed welds
      b. Anchorage
      c. Expansion provisions
      d. Glazing
      e. Flashing and drainage

G. Entrance Door Hardware Schedule:
   1. Schedule shall be prepared by or under the supervision of supplier.
   2. Schedule shall detail fabrication and assembly of entrance door hardware, including procedures and diagrams.
   3. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer must have successfully installed the same or similar units required for the project and other projects of similar size and scope.

B. Manufacturer Qualifications:
   1. Manufacturer must be capable of providing aluminum-framed storefront systems that meet or exceed performance the stated performance requirements.
   2. Manufacturer must document this performance by the inclusion of test reports and calculations.

C. Source Limitations:
   1. Obtain aluminum-framed storefront system through one source from a single manufacturer.

D. Product Options:
   1. Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Product Requirements Section. Do not modify size and dimensional requirements.
   2. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

E. Mockups:
   1. Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   2. Build mockups for the type(s) of storefront elevation(s) indicated, in location(s) shown on drawings.

F. Pre-installation Conference:
   1. Conduct conference at project site to comply with requirements in Division 01 Project Management and Coordination Section.

G. Structural-Sealant Glazing must comply with ASTM C 1401, “Guide for Structural Sealant Glazing” for design and installation of structural-sealant-glazed systems.

H. Structural-Sealant Joints: Design reviewed and approved by structural-sealant manufacturer.

1.7 PROJECT CONDITIONS

A. Field Measurements:
   1. Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication.
   2. Indicate measurements on shop drawings.

1.8 WARRANTY

A. Submit manufacturer's standard warranty for owner's acceptance.

B. Warranty Period:
   1. Two years from Date of Substantial Completion of the project provided however that in no event shall the Limited Warranty begin later than six months from date of shipment by manufacturer.

PRODUCTS

1.9 MANUFACTURERS

A. Basis-of-Design Product:
   1. Kawneer Company, Inc.
   2. Trifab Versaglaze 601T Framing System - Impact Glazing
      a. 2" x 6" (50.8 mm x 152.4 mm) nominal dimension
      b. Thermal
      c. Center Plane
      d. Screw Spline Fabrication

B. Types of Kawneer Aluminum Storefront Systems include:
   1. Exterior Storefront: Trifab® Versaglaze 601T Framing System - Impact Glazing
      a. 2" x 6" (50.8 mm x 152.4 mm) nominal dimension
      b. Thermal
      c. Center Plane
      d. Screw Spline Fabrication
   2. Interior Storefront: Trifab® VersaGlaze® 451 Framing System
      a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
      b. Non-thermal
      c. Front, center, back, multi-plane, structural silicone or weatherseal (type B) glazed
      d. Screw spline, shear block, stick, or punched opening
   3. Clerestory: Trifab® VersaGlaze® 451T Framing System
      a. 2" x 4-1/2" (50.8 mm x 114.3 mm) nominal dimension
      b. Thermal

C. Substitutions: Refer to section 01 25 13.

1.10 MATERIALS

A. Aluminum Extrusions:
   1. Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish
   2. Not less than 0.070" (1.8 mm) wall thickness at any location for the main frame
   3. Complying with ASTM B221: 6063-T6 alloy and temper

B. Fasteners:
   1. Aluminum, nonmagnetic stainless steel or other materials must be non-corrosive and compatible with aluminum members, trim hardware, anchors, and other components.

C. Anchors, Clips, and Accessories:
   1. Anchors, clips, and accessories shall provide sufficient strength to withstand the design pressure indicated.

D. Reinforcing Members:
   1. Reinforcing members must provide sufficient strength to withstand the design pressure indicated.

E. Sealant:
   1. For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

F. Tolerances:
   1. References to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

1.11 STOREFRONT FRAMING SYSTEM

A. Thermal Barrier:
   1. Trifab Versaglaze 601T:
      a. Kawneer IsoLock™ Thermal Break with a nominal 1/4" (6.4 mm) separation consisting of a two-part chemically curing, high-density polyurethane, which is mechanically and adhesively joined to aluminum storefront sections.

B. Brackets and Reinforcements:
   1. Manufacturer's standard high-strength aluminum with non-staining, non-ferrous shims for aligning system components.

C. Fasteners and Accessories:
   1. Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories must be compatible with adjacent materials.
   2. Where exposed, fasteners and accessories shall be stainless steel.

D. Perimeter Anchors:
   1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

E. Packing, Shipping, Handling, and Unloading:
   1. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

F. Storage and Protection:
   1. Store materials so that they are protected from exposure to harmful weather conditions.
   2. Handle material and components to avoid damage.
   3. Protect material against damage from elements, construction activities, and other hazards before, during, and after installation.

1.12 GLAZING SYSTEMS

A. Glazing to meet requirements in Division 08 Glazing Section.

B. Glazing Gaskets:
   1. Manufacturer's standard compression types
   2. Replaceable, extruded EPDM rubber

C. Spacers and Setting Blocks:
   1. Manufacturer's standard elastomeric type

D. Bond-Breaker Tape:
   1. Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants for structural-sealant-glazed systems as recommended by manufacturer for joint type, and as follows:
   1. Weatherseal sealant:
      a. ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O
      b. Single-component neutral-curing formulation that is compatible with the structural sealant and other system components with which it comes in contact
      c. Recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use
      d. Color: Matching structural sealant

1.13 ENTRANCE DOOR SYSTEMS

A. Refer to Entrance Doors as specified in Division 08 41 13 Aluminum-Framed Entrances and Storefronts Section.

B. Refer to Entrance Door Hardware as specified in Division 08 71 00 Door Hardware.

1.14 ACCESSORY MATERIALS

A. Joint Sealants:
   1. For installation at perimeter of aluminum-framed systems, as specified in Division 07 Joint Sealants Section.

B. Bituminous Paint:
   1. Cold-applied asphalt-mastic paint
   2. Complies with SSPC-Paint 12 requirements except containing no asbestos
   3. Formulated for 30-mil (0.762 mm) thickness per coat

1.15 FABRICATION

A. Fabricate framing member components that, when assembled, have the following characteristics:
   1. Profiles that are sharp, straight, and free of defects or deformations
   2. Accurately fitted joints that are flush, hairline, and weatherproof
   3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior
   4. Physical and thermal isolation of glazing from framing members
   5. Accommodations for thermal and mechanical movements of glazing and framing that maintain required glazing edge clearances
   6. Provisions for field replacement of glazing
   7. Fasteners, anchors, and connection devices that are concealed from view to the greatest extent possible

B. Mechanically Glazed Framing Members:
   1. Fabricate for flush glazing without projecting stops.

C. Structural-Sealant-Glazed Framing Members:
   1. Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.

D. Storefront Framing:
   1. Fabricate components for assembly using manufacturer’s standard installation instructions.

E. After fabrication, clearly mark components to identify their locations in project according to shop drawings.

1.16 ALUMINUM FINISHES

A. Finish designations that are prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing:
   1. Kawneer Permanodic® AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color Light Bronze)

PART 2 EXECUTION

2.1 EXAMINATION

A. With installer present, examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work:
   1. Verify rough opening dimensions.
   2. Verify levelness of sill plate.

3. Verify operational clearances.
4. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components for proper water management.
5. Masonry Surfaces:
    a. Masonry surfaces must be visibly dry and free of excess mortar, sand, and other construction debris.
6. Wood Frame Walls:
    a. Wood frame walls must be dry, clean, sound, well nailed, free of voids, and without offsets at joints.
    b. Ensure that nail heads are driven flush with surfaces in opening and within 3" (76.2 mm) of opening.
7. Metal Surfaces:
    a. Metal surfaces must be dry and clean (free of grease, oil, dirt, rust, corrosion, and welding slag).
    b. Ensure that metal surfaces are without sharp edges or offsets at joints.

B. Proceed with installation only after correcting unsatisfactory conditions.

2.2 INSTALLATION

A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.

B. Install aluminum-framed storefront system so that components:
1. Are level, plumb, square, and true to line
2. Are without distortion and do not impede thermal movement
3. Are anchored securely in place to structural support
4. Are in proper relation to wall flashing and other adjacent construction

C. Set sill members in bed of sealant or with gaskets, as indicated, for weather-tight construction.

D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.

E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

2.3 FIELD QUALITY CONTROL

A. Field Tests:
1. Architect shall select storefront units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured.
2. Conduct tests for air infiltration and water penetration with manufacturer’s representative present.

3. Tests that do not meet the specified performance requirements and units that have deficiencies shall be corrected as part of the contract amount.
4. Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.
5. Air Infiltration Tests:
    a. Conduct tests in accordance with ASTM E 783.
    b. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.
6. Water Infiltration Tests:
    a. Conduct tests in accordance with ASTM E 1105.
    b. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 6.2 psf (300 Pa).

B. Manufacturer's Field Services:
1. Upon owner’s written request, provide periodic site visit by manufacturer’s field service representative.

2.4 ADJUSTING, CLEANING, AND PROTECTION

A. Adjusting: Not applicable.

B. Protection:
1. Protect installed product’s finish surfaces from damage during construction.

C. Cleaning:
1. Clean glass immediately after installation.
    a. Comply with glass manufacturer's written recommendations for final cleaning and maintenance.
    b. Remove non-permanent labels and clean surfaces.
2. Clean aluminum surfaces.
3. Avoid damaging protective coatings and finishes.
4. Remove excess sealants, glazing materials, dirt, and other substances.
5. Repair or replace damaged installed products.
6. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during the construction period.
7. Remove construction debris from project site and legally dispose of debris.

END OF SECTION 08 41 13

SECTION 08 44 13 ALUMINUM CURTAIN WALL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
1. Aluminum-framed curtain wall system.

1.02 REFERENCES

A. American Architectural Manufacturers Association:
1. AAMA 501 - Methods of Test for Exterior Walls.
2. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum.
3. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
4. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site.
5. AAMA MCWM-1 - Metal Curtain Manual.
6. AAMA SFM-1 - Aluminum Store Front and Entrance Manual.

B. ASTM International:
1. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
2. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
3. ASTM 6209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate,
4. ASTM 8221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
5. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference.

C. SSPC: The Society for Protective Coatings: SSPC Paint 20 - Zinc-Rich Primers (Type I - Inorganic and Type 11 - Organic).

1.03 SYSTEM DESCRIPTION

A. Glazed aluminum curtain wall system includes: tubular aluminum sections; shop fabricated, factory finished, with glass and glazing specified in Section 08800 and installed by this Section; related flashings, anchorage and attachment devices.
1. System to be re-glazable from exterior.

B. System Assembly: Site assembled.

1.04 PERFORMANCE REQUIREMENTS

A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads. Failure also includes the following.
a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Loosening or weakening of fasteners, attachments, and other components.
d. Failure of operating units.

B. Delegated Design: Design glazed aluminum curtain walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

C. Wind loads: Provide Curtain Wall system; include anchorage, capable of withstanding wind load design pressures as noted in the drawings.

D. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 (0.3 l/s · m^2) at a static air pressure differential of 6.2 psf (300 Pa).

E. Water Resistance, (static): The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a static air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

F. Water Resistance, (dynamic): The test specimen shall be tested in accordance with AAMA 501.1. There shall be no leakage at an air pressure differential of 12 psf (575 Pa) as defined in AAMA 501.

G. Uniform Load: A static air design load of 40 psf (1915 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member at design load. At structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.

H. Energy Efficiency:
   1. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: 0.66 (clear) BTU/hr/ft^2/°F per AAMA 507

I. Condensation Resistance (CRF): When tested to AAMA Specification 1503, the condensation resistance factor shall not be less than 66frame and 60glass (clear).

   or

   Condensation Index (I): when tested to CSA-A440-00, the Condensation Index shall not be less than 68_{frame} and 54_{glass} (clear).

J. Sound Transmission Loss: When tested to ASTM E90 and ASTM E1425, the Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) shall not be less than:
   1. STC 37 or OITC 30 based upon 1" (25.4) laminated glass (1/4" laminated, 1/2" AS, 1/4" laminated).

K. Windborne-Debris-Impact Resistance Performance: Shall be tested in accordance with ASTM E1886, information in ASTM E1996, and TAS 201/203.
   1. Large – Missile Impact: For aluminum-framed systems located within 30 feet (9.1 m) of grade.

   2. Small – Missile Impact: For aluminum-framed systems located above 30 feet (9.1 m) of grade.

1.05 SUBMITTALS

A. Shop Drawings: indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

B. Structural Analysis Data: Include structural analysis data and shop drawings related to system anchorage that are signed and sealed by the Professional Engineer registered in the state of Texas who is responsible for their preparation. Engineer shall also provide structural analysis data, signed and sealed, for system Performance Requirements that are not certified by manufacturer.

C. Product Data: Submit component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

D. Samples: Submit two samples 12 x 12 inches in size illustrating finished aluminum surface.

E. Design Data: Indicate framing member structural and physical characteristics and dimensional limitations.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with AAMA MCWM-1 - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

1.07 QUALIFICATIONS

A. Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years experience.

1.08 PRE-INSTALLATION MEETINGS

A. Section 01300 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum one week prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND PROTECTION

A. Section 01600 - Product Requirements: Product storage and handling requirements.

B. Handle Products of this section in accordance with AAMA MCWM-1 - Curtain Wall Manual.

C. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 ENVIRONMENTAL REQUIREMENTS

A. Section 01600 - Product Requirements.

B. Do not install sealants nor glazing materials when ambient temperature is less than 40 degrees F during and 48 hours after installation.

1 .11 WARRANTY

A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period,

1. Failures include, but are not limited to, the following:
   a. Structural failures including, but not limited to, excessive deflection.
   b. Noise or vibration caused by thermal movements.
   c. Deterioration of metals and other materials beyond normal weathering.
   d. Adhesive or cohesive sealant failures.
   e. Water leakage through fixed glazing and framing areas.
   f. Failure of operating components to function properly.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
   1. Warranty Period: 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 ALUMINUM CURTAIN WALL SYSTEMS
A. Basis-of-Design Product.
   1. Kawneer Company Inc.
      a. 1600 Wall System™1 IR Curtain Wall – 2-1/2", outside glazed pressure plate format; with continuous fillers at head and jamb locations
      b. System depth: 10-1/2" depth for 1-5/16" insulating glazing.

B. Subject to compliance with the requirements of this section, provide a comparable product by the following.Manufacturers:
   1. EFCO Corporation www.efcocorp.com
   2. United States Aluminum. www.usalum.com
   3. Vistawall Architectural Products. www.vistawall.com/
   4. Columbia Commercial Building Products www.ccbpwin.com
   5. YKK-AP America, Inc.
   6. Substitutions: Refer to Section 01 25 13

2.02 CURTAIN WALL COMPONENTS
A. Materials
1. Aluminum Extrusions: Alloy and temper recommended by glazed aluminum curtain wall manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.78) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
2. Aluminum sheet alloy: Shall meet the requirements of ASTM B209.
3. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum window members, trim hardware, anchors, and other components.
4. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
5. Pressure Plate: Pressure plate shall be aluminum and fastened to the mullion with stainless steel screws.
6. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
7. Sealant: For sealants required within fabricated curtain wall system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.
8. Thermal Barrier: Thermal separator shall be extruded of a silicone compatible elastomer that provides a minimum 1/4" (6.3) separation.

9. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of glazed curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.

2.03 CURTAIN WALL FRAMING

2.04 GLAZING

A. Glazing: Comply with Division 08 Section “Glazing”. Following glazing options are available.
   1. 1600 Wall System 1 IR Curtain Wall.
      a. System depth: 7-13/16" depth for 1-5/16" insulating glazing.

B. Glazing Gaskets: Gaskets to meet the requirements of ASTM C864.

C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.

D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.

E. Glazing Sealants: As recommended by manufacturer for joint type.

2.05 ACCESSORY MATERIALS

A. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

2.06 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Fabricate components that, when assembled, have the following characteristics.
   1. Profiles that are sharp, straight, and free of defects or deformations.
   2. Accurately fitted joints.
   3. Physical and thermal isolation of glazing from framing members.
   4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   5. Provisions for field replacement of glazing from exterior.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   7. Internal weeping system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

C. Curtain Wall Framing: Fabricate components for assembly using shear block system following manufacturer's standard installation instructions.

D. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

2.07 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Factory Finishing.

C. Kawneer Permanodic™ AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install curtain wall systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions. Provide support and anchor in place.

1. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
2. Glazing: Glass shall be outside glazed and held in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 9" (228.6) on center.
3. Water Drainage: Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

B. Related Products Installation Requirements.

1. Sealants (Perimeter): Refer to Joint Treatment (Sealants) Section.
2. Glass: Refer to Glass and Glazing Section.
3. Reference: ANSI Z97.1, CPSC 16 CFR 1201 and GANA Glazing Manual.

3.03 FIELD QUALITY CONTROL

A. Field Tests: Architect shall select curtain wall units to be tested as soon as a representative portion of the project has been installed, glazed, perimeter caulked and cured. Conduct tests for air infiltration and water penetration with manufacturer's representative present. Tests not meeting specified performance requirements and units having deficiencies shall be corrected as part of the contract amount.

B. Testing: Testing shall be performed per AAMA 503 by a qualified independent testing agency. Refer to Testing Section for payment of testing and testing requirements.

1. Air Infiltration Tests: Conduct tests in accordance with ASTM E 783. Allowable air infiltration shall not exceed 1.5 times the amount indicated in the performance requirements or 0.09 cfm/ft^2, whichever is greater.

2. Water Infiltration Tests: Conduct tests in accordance with ASTM E 1105. No uncontrolled water leakage is permitted when tested at a static test pressure of two-thirds the specified water penetration pressure but not less than 8 psf (383 Pa).

A. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

3.04 ADJUSTING, CLEANING AND PROTECTION

A. Protection: Protect installed product's finish surfaces from damage during construction. Protect aluminum curtain wall system from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.

B. Cleaning: Repair or replace damaged installed products. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.

C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 08 44 13

SECTION 08 71 00 DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Aluminum-Framed Entrances and Storefronts”.
4. Division 28 Section “Access Control Hardware Devices”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:

1. ANSI/BHMA Certified Product Standards - A156 Series

2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
   a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
   b. Complete (risers, point-to-point) access control system block wiring diagrams.

c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Proof of Certification: Provide copy of manufacturer(s) official certification or accreditation document indicating proof of status as a qualified and authorized provider of the primary Integrated Wiegand Access Control Products.

E. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

F. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Integrated Wiegand, Wireless, and IP-Enabled Access Control Products Supplier Qualifications: Integrated access control products and accessories are required to be supplied and installed through current members of the ASSA ABLOY "Authorized Channel Partner" (ACP) and "Certified Integrator" (CI) programs. Suppliers are to be factory trained, certified prior to

project bid, and a direct purchaser of the specified product. Installers are to be factory trained, certified prior to project bid, and are responsible for commissioning, servicing, and warranting the installed equipment specified for the project.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closer bodies.
4. Five years for motorized electric latch retraction exit devices.
5. Two years for electromechanical door hardware.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
   b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.

3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.

4. Hinge Options: Comply with the following:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.

5. Manufacturers:

   a. Hager Companies (HA) - CB Series.
   b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.

B. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Manufacturers:

   a. Dorma Products (DO).
   b. Rixson Door Controls (RF).

2.3 POWER TRANSFER DEVICES

A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

   a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
   b. Securitron (SU) - EL-CEPT Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

a. Sargent Manufacturing (SA).
b. No Substitution.

C. Cylinders: Original manufacturer cylinders complying with the following:

1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.

2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. **The hardware distributor provides cylinders for Access control devices, locks and exits.**
6. Keyway: Match Facility Standard.

D. Security Cylinders: ANSI/BHMA A156.5, Grade 1, patterned security cylinders and keys able to be used together under the same facility master or grandmaster key system. Cylinders are to be factory keyed.

1. Manufacturers:

a. Sargent Manufacturing (SA) - Signature Series at exterior.
b. No Substitution.
c. 10- Signature supplied on the exterior side of opening only. Not at Mullions or 16- Cylinder dogging

E. Keying System: Each type of lock and cylinders to be factory keyed.

1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a **visual key control number as directed by Owner.**
3. New System: Key locks to a new key system as directed by the Owner.

F. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder Group: Seven (7).
2. Master Keys (per Master Key Level/Group): Ten (10).
3. Signature Key Blanks: 150ea
4. Standard Key Blanks: 100ea

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

a. Lund Equipment (LU). 1205A

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

a. Sargent Manufacturing (SA) – 8200 Series.
b. No Substitution.

2.7 AUXILIARY LOCKS

A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 4870 Series.
b. No Substitution.

B. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 certified narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8” diameter bolts.

1. Manufacturers:

a. Adams Rite Manufacturing (AD) - MS1850S Series

2.8 INTEGRATED WIRED OUTPUT LOCKING DEVICES – MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Mortise Locks: Wiegand or Open Supervised Device Protocol (OSDP) output ANSI A156.13, Grade 1, mortise lockset with integrated card reader with or without keypad option, request-to-exit signaling, door position status switch, and latchbolt monitoring in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle trim, 3/4" deadlocking anti-friction latch, and 1" case-hardened steel deadbolt. Lock is U.L listed and labeled for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Latchbolt monitoring and door position switch act in conjunction to report door-in-frame (DPS) and door latched (door closed and latched) conditions.
2. Integrated reader supports the following credentials:
   a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
   b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
   c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
   d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
   e. NFC-enabled mobile phones
   f. PIN code only or PIN + credential with keypad option.
3. 12VDC external power supply required for reader and lock, with optional 24VDC lock solenoid. Fail safe or fail secure options.
4. Energy Efficient Design: Provide lock bodies which have a holding current draw of 500mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
5. Support end-of-line resistors contained within the lock case.
6. Installation requires only one cable run from the lock to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
7. Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.
8. Manufacturers:
   a. Sargent Manufacturing (SA) – SN200/SN210 8200 Series.
   b. No Substitution.

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.

6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.

9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

12. **No self-tapping screws allowed. Drill and tap at all machine screw locations.**

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.
b. No Substitution.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish.

1. Provide keyed removable feature where specified in the Hardware Sets.

2. Provide stabilizers and mounting brackets as required.

3. Provide electrical quick connection wiring options as specified in the hardware sets.

4. Manufacturers:

a. Sargent Manufacturing (SA) - 980S Series.

2.11 INTEGRATED WIRED OUTPUT EXIT DEVICES - MULTI-CLASS READER

A. Integrated Wired Output Multi-Class Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated card reader with or without keypad option, latchbolt and touchbar monitoring, and request-to-exit signaling, in one complete unit. Hard wired, solenoid driven locking/unlocking control of the lever handle exit trim with 3/4" throw latch bolt. U.L listed and labeled for either panic or "fire exit hardware" for use on up to 3 hour fire rated openings. Available with or without keyed high security cylinder override.

1. Open architecture, hard wired platform supports centralized control of locking units with new or existing Wiegand or OSDP compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected DPS).
2. Integrated reader supports the following credentials:
   a. 125kHz proximity credentials: HID, AWID, Indala, and EM4102.
   b. 13.56 MHz proximity credentials: HID Secure Identity Object™ (SIO) on iCLASS Seos, HID iCLASS, HID iCLASS SE/SR, MIFARE Classic, DESFire EV1 and EV2.
   c. 2.4 GHz credentials: Secure Identity Object™ (SIO) on Mobile IDs (Bluetooth Smart)
   d. ISO14443A/B (PIV-compatible Transparent FASC-N read) available with pivCLASS variant
   e. NFC-enabled mobile phones
   f. PIN code only or PIN + credential with keypad option

3. 12VDC external power supply required for reader. 24VDC required for solenoid operated exit trim. Fail safe or fail secure options.
4. Installation requires only one cable run from the exit hardware to the access control panel without requirements for additional proprietary lock panel interface boards or modules.
5. Competitor Alternates Allowed Option: Installation to include manufacturer's access control panel interface board or module where required for Wiegand or OSDP output protocol.

6. Manufacturers:

    a. Sargent Manufacturing (SA) – SN200/SN210 80 Series.
    b. No Substitution.

2.12 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.

4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.

5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
7. **Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.**

8. **No self-tapping screws allowed. Drill and tap at all machine screw location.**

9. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and

fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - 351 Series.
    b. No Substitution.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor

stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide DPDT, surface mounted switches.

1. Manufacturers:

    a. Sentrol (SE) – 2507AD-L.

Power Supplies – By Security

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Testing procedures for access control doors are essential to ensure that the system is functioning correctly and providing the necessary level of security.

1. Test the door lock: Verify that the door lock is functioning correctly. Test the lock by using a key or code to unlock the door and ensure that it locks properly when closed.
2. Test the door hardware: Check the door hardware, including the hinges, locks, and other components, to ensure that they are functioning correctly. Verify that the door opens and closes smoothly, and that the hardware is secure.
3. Test the access control equipment using Wiegand tester.
   a. Test card reader by enrolling card into Wiegand Tester. Verify that the lock is working correctly by ensuring that the door unlocks and locks properly when presenting card to reader.
   b. Test Door Position Switch (DPS) by opening door to ensure that the sensors detect open and close signal on Wiegand Tester.
   c. Test Request to Open (REX) using Wiegand Tester to ensure getting open and short signal.

4. Document the results: Keep a record of the testing results and any issues that were identified. This will help you to identify any recurring issues and ensure that the access control system is functioning correctly. Overall, testing procedures for access control doors are critical to ensuring that the system is functioning correctly and providing the necessary level of security. By following these procedures, you can identify any issues and address them before they become a problem.

C. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

D. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work complies with or deviates from specification requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set

should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Manufacturer's Abbreviations:

1. MK - McKinney
2. RF - Rixson
3. SA - SARGENT
4. RO - Rockwood
5. PE - Pemko
6. OT - Other
7. SU – Securitron
8. SE - Sentrol

Hardware Sets based on plans dated 11/08/2023 – 95%CD - Plotted 12/15/2023

Set: 1.0
Doors: A100, B101, B101A, C107B, C107C, C108B, C108C, C119, C121, E101, E101A, F100, F101, F101A
Description: *Ext - Alum - Pair - Rim SN200 MELR - KRM - Closer/stop

2	Intermediate Pivot	M190	626	RF
2	Pivot Set	195	626	RF
1	Electric Power Transfer	EL-CEPT	630	SU
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	Rim Exit Device	10 TB 43 56-SN200-8804 BIS-OE 862		US32D SA
1	Rim Exit DT	16 TB 43 8810 862	US32D	SA
1	Cylinder	980C1	US26D	SA
2	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
2	Kit	581-2	EN	SA
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
2	Sweep w/ Drip	3452AV		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
1	Perimeter Seal	By door mfgr		OT
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times.

Set: 2.0
Doors: A103, A114, A126B, F116B
Description: *Ext - Alum - Sgl - Rim SN200, MELR - Closer/stop

1	Intermediate Pivot	M190	626	RF
1	Pivot Set	195	626	RF
1	Electric Power Transfer	EL-CEPT	630	SU
1	Rim Exit Device SA	10 TB 43 56-SN200-8804 BIS-OE 862		US32D
1	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
1	Lip Threshold	2005AT		PE
1	Rain Guard	346C		PE
1	Kit	581-2	EN	SA
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	Sweep w/ Drip	3452AV		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
1	Perimeter Seal	By door mfgr		OT
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times.

Set: 3.0
Doors: C120
Description: *Ext HM- Mechanical Pair - SN Exit - MFB - Closer/Stop

6	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Electric Power Transfer	EL-CEPT	630	SU
1	SN Rim Exit HM SA	10 TB 43 56-SN200-8804 BIS-0E FSW 644		US32D
1	Lip Threshold	2005AT		PE
1	Perimeter Seal	2891APK		PE
1	Rain Guard	346C		PE
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
2	Sweep w/ Drip	3452AV		PE
2	Astragal	303AS		PE
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
2	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Doors are normally closed and secure. Presentation of valid credential will allow entry by pull. Upon loss of power, doors will remain secure. Free egress at all times.

Set: 3.1
Doors: C112D, C120A
Description: *Ext HM - Egress Sgl -SN Exit - Closer/ Stop

3	Hinge (heavy weight)	T4A3386 NRP	US32D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	SN Rim Exit HM SA	10 TB 43 56-SN200-8804 BIS-0E FSW		US32D
1	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
1	Lip Threshold	2005AT		PE
1	Perimeter Seal	2891APK		PE
1	Rain Guard	346C		PE
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-CxxxP		MK
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Set: 4.0
Doors: A120, D103
Description: *Int - Sgl - IN220 Lock- Closer/stop - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Access Control Mort Lock	SN200-82271 BIS-0E LNJ	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Door Closer	TB 351 O / PS as required	EN	SA
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-CxxxP		MK
1	Gasketing	By the frame manufacturer		OT
1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid credential allows entry by trim. Upon loss of power doors will remain secure. Free egress at all times.

Set: 5.0
Doors: A109, A109A, B127, E130, F112
Description: *Int - Sgl - IN220 Lock- Closer - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Electric Power Transfer	EL-CEPT	630	SU
1	Access Control Mort Lock	SN200-82271 BIS-0E LNJ	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Door Closer	TB 351 O / PS as required	EN	SA

1	ElectroLynx Harness	QC-C1500P	MK
1	ElectroLynx Harness	QC-CxxxP	MK
1	Gasketing	By the frame manufacturer	OT
1	Position Switch (Surface Mounted)	2507AD-L	SE
1	Power Supply	By Security	OT

Notes: Valid credential allows entry by trim. Upon loss of power doors will remain secure. Free egress at all times.

Set: 6.0
Doors: A100A
Description: *Int - Alum - Pair - Rim SN200 MELR - KRM - Closer/stop

2	Intermediate Pivot	M190	626	RF
2	Pivot Set	195	626	RF
1	Electric Power Transfer	EL-CEPT	630	SU
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	Rim Exit Device	10 TB 43 56-SN200-8804 BIS-OE 862		US32D SA
1	Rim Exit DT	16 TB 43 8810 862	US32D	SA
1	Cylinder	980C1	US26D	SA
2	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
2	Kit	581-2	EN	SA
2	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	ElectroLynx Harness	QC-C1500P		MK
2	ElectroLynx Harness	QC-CxxxP		MK
1	Perimeter Seal	By door mfgr		OT
2	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times. Remote release located at reception desk is by security provider. Low voltage wiring.

Set: 7.0
Doors: A101, A104, A104A, A104B
Description: *Int - Alum - Sgl - SN200 Lock - Closer

1	Intermediate Pivot	M190	626	RF
1	Pivot Set	195	626	RF
1	Electric Power Transfer	EL-CEPT	630	SU
1	Access Control Mort Lock	10 SN200-82271 BIS-OE LNJ	US26D	SA
1	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
1	Kit	581-2	EN	SA
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	ElectroLynx Harness	QC-C1500P		MK
1	ElectroLynx Harness	QC-CxxxP		MK
1	Perimeter Seal	By door mfgr		OT

1	Position Switch (Surface Mounted)	2507AD-L		SE
1	Power Supply	By Security		OT

Notes: Valid card read allows entry by trim. Remote release buttons if required are by security contractor. Upon loss of power doors will remain secure unless dogged by cylinder. Free egress at all times. Remote release located at reception desk is by security provider. Low voltage wiring.

Set: 8.0
Doors: C103, C109
Description: Int - Pair - Storeroom MFB - Closer

6	Hinge, Full Mortise	TA2714	US26D	MK
1	Dust Proof Strike	570	US26D	RO
2	Flush Bolt	555 - 12"/72" A.F.F.	US26D	RO
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
2	Kick Plate	K1050 10" BEV CSK	US32D	RO
2	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
1	Perimeter Seal	S773BL		PE
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Astragal	18041CNB		PE

Notes: Closer on active leaf.

Set: 9.0
Doors: A132, C107, C107A, C108, C108A
Description: Int - Alum - Pair - Rim/CL Lever - KRM - Closer/stop

2	Intermediate Pivot	M190	626	RF
2	Pivot Set	195	626	RF
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	Rim Exit Device, DT Lever	TB 16 43 8810 ETJ GMK VK Keys	US32D	SA
1	Rim Exit Device, Classroom	TB 16 43 8813 ETJ GMK VK Keys	US32D	SA
1	Cylinder	980C1 GMK VK Keys - By 087100	US26D	SA
2	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
2	Kit	581-2	EN	SA
2	Closer w/ Stop Arm	TB 351 PS	EN	SA
1	Perimeter Seal	By door mfgr		OT

Notes: Wide stile required.

Set: 10.0
Doors: A132A
Description: Int - Pair - Rim/CL Lever - KRM - Closer/HO

6	Hinge (heavy weight)	T4A3786	US26D	MK
1	Mounting Kit	98-2579		SA
1	Mullion	L980S	PC	SA
1	Rim Exit Device, DT Lever	TB 16 43 8810 ETJ GMK VK Keys	US32D	SA

1	Rim Exit Device, Classroom	TB 16 43 8813 ETJ GMK VK Keys	US32D	SA
1	Cylinder	980C1 GMK VK Keys - By 087100	US26D	SA
2	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
2	Surface Closer	351 CPSH	EN	SA
1	Gasketing	By Frame Manufacturer		OT

Set: 11.0
Doors: A125, B125, B128, B129, C118, E113, E127, E128, F111, F127, F128
Description: Int - Sgl - Storeroom - Closer - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE
1	Door Closer	TB 351 UO	EN	SA

Notes: At aluminum frames, gasketing is by frame manufacturer.

Set: 12.0
Doors: A111, A119, A133, A134, B105, B106, B124, D111, D119, E110, E111
Description: Int - Sgl - Storeroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Gasketing	By the frame manufacturer		OT

Set: 13.0
Doors: C105, E115
Description: Int - Sgl - Storeroom - Wide

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Notes: At aluminum frames, gasketing is by frame manufacturer.

Set: 14.0
Doors: B123, B126, B136, C101, E112, E129, E131, F129, F130, F132
Description: Int - Sgl -Storeroom - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO

1	Door Closer	TB 351 UO	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 15.0
Doors: B103
Description: Int - Sgl -Storeroom - Closer /stop

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Heavy Duty Floor Stop	409 / 462 as req	US2C	RO
1	Closer w/ Stop Arm	TB 351 PS	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 16.0
Doors: A118
Description: Int - Sgl - Storeroom - Closer - Gasket

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Closer - pull side	TB 351 O	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 16.1
Doors: D107
Description: Int - Sgl - Storeroom - Closer - Gasket - Wide

3	Hinge (heavy weight)	T4A3786	US26D	MK
1	Storeroom/Closet Lock	8204 LNJ GMK VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Closer - pull side	TB 351 O	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 17.0
Doors: A114A, C115, F114
Description: Int - Sgl - Classroom - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	8237 LNJ GMK VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Door Closer	TB 351 UO	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 18.0
Doors: D112, D113, D116, D120, E114

Description: Int - Sgl - Office - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office/Entry Lock	8205 LNJ GMK VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Door Closer	TB 351 UO	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 19.0
Doors: C112A, C112B
Description: Int - Sgl - ASF Sec Classroom - Closer - Holder - Serving

1	Intermediate Pivot	M190	626	RF
1	Pivot Set	195	626	RF
1	Classroom Security Intruder Lock	8238 LNJ GMK VK Keys	US26D	SA
1	Kit	581-2	EN	SA
1	Closer w/ Stop/Hold	TB 351 PSH	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 20.0
Doors: A121
Description: Int - Sgl - Classroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Lock	8237 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Gasketing	By the frame manufacturer		OT

Set: 21.0
Doors: A112, A113, B111, B113
Description: Int - Sgl - Passage

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Passage Set	8215 LNJ	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Gasketing	By the frame manufacturer		OT

Set: 22.0
Doors: B132, B133, B134, B135, C117, D105, D106, E121, E122, E123, E124, F121, F122, F123, F124
Description: Int - Sgl - PP - DL - Closer

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Public Toilet Deadlock	4878 GMK VK Keys	US26D	SA
1	Push Plate	70E	US32D	RO
1	Pull Plate	111x70C	US32D	RO
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE

1	Door Closer	TB 351 O / PS as required	EN	SA

Notes: At aluminum frames, gasketing is by frame manufacturer.

Set: 23.0
Doors: A135, A135A, B107, B108, B109, B110, B112, B114, B115, B116, B117, B118, B119, B120, B121, B122, C100, D104, D108, D109, D114, D114A, D115, D115A, D122, D122A, D123, D123A, E103, E104, E105, E106, E107, E108, E109, E116, E117, E118, E119, E120, F103, F104, F105, F106, F107, F108, F109, F110, F117, F118, F119, F120
Description: Int - Sgl - Sec Classroom

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Classroom Security Intruder Lock	8238 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Notes: At aluminum frames, seals/silencers are by frame manufacturer.

Set: 24.0
Doors: D104
Description: Int - Alum Sgl - Sec Classroom

1	Intermediate Pivot	M190	626	RF
1	Pivot Set	195	626	RF
1	Classroom Security Intruder Lock	8238 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
1	Kit	581-2	EN	SA
1	Door Closer	TB 351 O / PS as required	EN	SA
1	Perimeter Seal	By door mfgr		OT

Notes: At aluminum frames, seals/silencers are by frame manufacturer.

Set: 25.0
Doors: A126, A128, A128A, A129, A129A, A130, A130A, A131, A131A, A135B, F116
Description: Int - Sgl - Sec Classroom Exit

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Rim Exit Device Sec CR Int SA	TB 16 43 49 8816 ETJ GMK VK Keys		US32D
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Closer w/ Stop Arm	TB 351 CPS	EN	SA
1	Gasketing	By the frame manufacturer		OT

Notes: At aluminum frames, seals/silencers are by frame manufacturer.

Set: 26.0
Doors: A105, A106, A107, A107A, A108, A115, A122, A123, A124, A136, B104, C106, C114, D102, F113, F115

Description: Int - Sgl - Office

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Office/Entry Lock	8205 LNJ GMK VK Keys	US26D	SA
1	Door Stop	409 / 462 as req	US32D	RO
3	Silencer	608		RO

Notes: At aluminum frame, gasketing / silencers are by frame manufacturer.

Set: 27.0
Doors: A102, A110, A116, A117, C116, D117, D121
Description: Int - Sgl - Privacy - 8225

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Dormitory/Exit Lock	V20 EMB 8225 VN1J VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Perimeter Seal	S773BL		PE
1	Door Closer	TB 351 UO	EN	SA

Notes: At aluminum frames, gasketing is by frame manufacturer.

Set: 28.0
Doors: B130, B131, D110, E125, E126, F125, F126
Description: Int - Sgl - Privacy - Staff - 8251

3	Hinge, Full Mortise	TA2714	US26D	MK
1	Storeroom Deadbolt Lock	V20 EMB 8251 VN1J VK Keys	US26D	SA
1	Kick Plate	K1050 10" BEV CSK	US32D	RO
1	Door Stop	409 / 462 as req	US32D	RO
1	Door Closer	TB 351 UO	EN	SA
1	Gasketing	By the frame manufacturer		OT

Set: 29.0
Doors: B101B, C108F, C112C, E101B, F101B
Description: Cylinder Only

1	Cylinder Ring	1KB-1		SA
2	Cylinder	as required GMK VK Keys	US32D	SA
1	Balance hardware	by the door manufacturer		OT

Notes: Confirm cylinder type required with door manufacturer.

Set: 29.1
Doors: A137, A138, A139, C108D
Description: Folding Panel

1	All Hardware	By Door Manufacturer		OT

Set: 30.0
Doors: Misc
Description: MISC

50	Master Key	10-S6272MK	SA
100	Key Blank	6275	SA
150	Key Blank	10-6275	SA
1	Key Cabinet	1205-A 400 Double Tag Key Box	LU
1	Badge Holders	Mifflin USA Clear 2.25x3.5 250 pack	OT

END OF SECTION 087100

SECTION 08 80 00 GLASS AND GLAZING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Window Glass.
B. Door Glass - Safety Glazing.
C. Glazed Entrances
D. Interior Glass Lites
E. Security Glazing – Refer to section 08 88 53

1.02 RELATED SECTIONS

A. Contractor, at its option, may furnish doors and windows factory-glazed and deliver such doors and windows to the site pre-glazed. Glass and glazing of factory-glazed doors and windows shall conform with the requirements specified herein.

1.03 MEASUREMENT AND PAYMENT

A. General: Glass and glazing will not be measured separately for payment but will be paid for as part of the Contract lump sum price for Architectural Work.

1.04 REFERENCES

A. American National Standards Institute (ANSI): ANSI Z97.1 Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

B. All window glazing shall demonstrate full compliance with Section 502.4.1 of the 2009 International Energy Conservation Code.

C. American Society for Testing and Materials (ASTM):

1. ASTM C509 - Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
2. ASTM C669 - Specification for Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
3. ASTM C864 - Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
4. ASTM C920 - Specification for Elastomeric Joint Sealants
5. ASTM C1036 - Specification for Flat Glass
6. ASTM C1048 - Specification for Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass
7. ASTM C1172 - Specification for Laminated Architectural Flat Glass
8. ASTM D790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
9. ASTM 1376 - Standard Specification for Pyrolitic and Vacuum Deposition Coatings on Flat Glass.
10. ASTM E 2188 - Standard Test Method for Insulating Glass Unit Performance.
11. ASTM E 2189 - Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
    ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.9. ASTM D2240 - Test Method for Rubber Property - Durometer Hardness
12. ASTM E773 - Test Methods for Seal Durability of Sealed Insulating Glass Units

13. ASTM E774 - Specification for Sealed Insulating Glass Units
14. ASTM F36 - Test Method for Compressibility and Recovery of Gasket Materials

D. Code of Federal Regulations (CFR): Title 16, Part 1201, Safety Standard for Architectural Glazing Materials (16 CFR 1201)

E. Glass Association of North America (FGMA): FGMA Glazing Manual

F. National Fire Protection Association (NFPA): NFPA 80 Fire Doors and Fire Windows

1.05 DEFINITIONS

A. Manufacturers of Glass Products: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

C. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or other specified gas.

D. Sealed Insulating Glass Unit Surface Designations:

1. Surface 1 - Exterior surface of the outer glass lite.
2. Surface 2 - Interspace surface of the outer glass lite.
3. Surface 3 - Interspace surface of the inner glass lite.
4. Surface 4 - Interior surface of the inner glass lite.

E. Fully Tempered Glass (FT): Glass that has been heat-treated to have either a minimum surface compression of 10,000 psi or an edge compression not less than 9,700 psi in accordance with requirements of ASTM C 1048, kind FT and meet the requirements of ANSI Z97.1 or CPSC 16 CFR 1201 safety glazing standards. May be used as safety glazing as required by code.

F. Laminated Glass (LG): Two or more pieces of glass bonded together by a piece of plastic/vinyl called polyvinyl butyral (PVB). A minimum interlayer thickness of .030 in. (.76 mm) and meets the requirements of ANSI Z97.1 or CPSC 16 CFR 1201 safety glazing standards. May be used as safety glazing as required by code.

G. Low-E: An abbreviation for Low Emissivity coating applied to glass to reflect invisible long-wave infrared or heat. Coating reduces heat gain or loss and provides greater light transmission, low reflection and reduces heat transfer.

H. Insulating Glass (IG): Two glass components separated by an air space and hermetically sealed to increase a window's thermal performance.

I. Insulating Laminated Glass: An insulated glass unit in which the exterior component is a monolithic glass ply and the interior component is a laminated glass.

J. Heat Strengthened Glass (HS): Glass that has been heat-treated to have a surface compression between 3,500 and 7,500 psi and meets the requirements for ASTM C 1048, kind HS. HS glass shall not be used as safety glazing and will not meet the requirements of ANSI Z97.1 or CPSC 16 CFR 1201.

1.06 SUBMITTALS

A. Product Data: Submit manufacturer's product data for each glass product and glazing material indicated with the following performance data:
1. Visible Light Transmittance (VLT)
2. Visible Light Reflectance Exterior %
3. Visible Light Reflectance Interior %
4. (BTU/hr°ft2°°F) NFRC U-Value
5. Solar Heat Gain Coefficient (SHGC)
6. Light to Solar Gain (LSG)

B. Samples:

1. Submit 12-inch by 12-inch sample of each type, thickness, and color of glass to be installed. For insulated glass, submit as total composite sample. Identify each sample with the manufacturer's name, product name, type of glass, thickness, color designation, and installation location. Protect sample edges for handler's safety.

2. Submit 12-inch samples of each type of glazing gasket, and tape, and glazing compound, identified with manufacturer's name, product name, and type of material.

C. Certificates: Submit certification that insulating glass units furnished and installed are faithful replicas of insulating glass units that have passed the program of testing specified in ASTM E773. For solar-control low-e-coated glass, provide documentation demonstrating that manufacturer of coated glass is certified by coating manufacturer.

D. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

1.07 QUALITY ASSURANCE

A. Safety Glazing:

1. Fully Tempered and laminated glass shall be horizontally treated; vertical treatment will not be acceptable. Fabrication and treatment shall be such that roller distortion lines (where they may occur) run horizontally (parallel to sill and head) after installation.

2. Tempered glass shall bear the manufacturer's identification as to type and thickness. Such identification for glazing shall be permanently etched so as to be visible after glass has been installed. Glass other than fully tempered (FT) glass shall not have etched labels.

3. Safety glazing shall comply with testing requirements in CPSC 16 CFR 1201.

4. Safety glazing (tempered – impact resistant) shall be used in all locations.

B. Identification: Label each pane of glass and glass unit with type, thickness, quality, and color of glass and with manufacturer's trade name.

C. Glazing: Glazing compounds and methods of glazing shall conform with applicable requirements of FGMA Glazing Manual.

E. Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.

F. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

1.08 INSTALLER QUALIFICATIONS

A. Glass Installer must be experienced and shall have completed glazing similar in material, design and extent to that indicated for this project. Installer shall have a record of successful in-service glass installations and shall employ glass installers who are certified under the National Glass Association Glazier Certification Program as Level 2 (Senior Glaziers) or Level 3 (Master Glaziers).

1.09 DELIVERY, STORAGE AND HANDLING

A. Protect glazing materials according to manufacturer’s written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sunlight or other causes.

B. For insulating-glass units that will be exposed to substantial altitude changes, comply with insulating-glass manufacturer's written recommendations for venting and sealing to avoid hermetic seal ruptures.

1.10 PROJECT CONDITIONS

A. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation or other causes.

B. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturer or below 40 degrees F.

1.11 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturers Special Warranty for Coated-Glass Products: Manufacturers standard form, made out to Owner and signed by coated glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturers Special Warranty on Safety Glass (Tempered Glass): Manufacturers standard form, made out to Owner and signed by tempered glass manufacturer agreeing to replace

tempered glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: Five years from date of Substantial Completion.

D. Manufacturers Special Warranty on insulating Glass: Manufacturers standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:
1. Design Wind Pressures: As indicated on Drawings.
2.. Wind Design Data: As indicated on Drawings.

D. Windborne-Debris-Impact Resistance: Exterior glazing shall pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 1 for basic protection.
1. Large-Missile Test: For glazing located within 30 feet of grade.
2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade.

2.02 GLASS

A. Glass Standards and Requirements: Glass materials shall conform with ASTM C1036 for float glass and ASTM C1048 for heat-strengthened and tempered glass, as applicable. Types and thicknesses of glass shall be as indicated.

B. Clear Float Glass: ASTM C1036, Type I, Class 1, Quality q3, with flat, smooth and glossy surfaces for architectural glazing.

C. Tinted Float Glass: ASTM C1036, Type I, Class 2, Quality q3, of tint color indicated, with flat smooth and glossy surfaces for architectural glazing.

D. Clear Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 1, Quality q3.

E. Tinted Tempered Glass: ASTM C1048, Kind FT, Condition A, Type I, Class 2, Quality q3, of tint color indicated.

F. Laminated Tempered Glass: Made up of two panes of fully tempered (FT), Type I, Class 1, Quality q3 glass of thicknesses indicated, with special 0.060-inch vinyl interlayer, meeting requirements of ASTM C1172.

G. Insulating Glass: Preassembled unit, comprising two organically sealed panes of clear tempered glass separated by dehydrated (desiccated) air space, of sizes and thicknesses indicated, meeting requirements of ASTM E774.

2.03 GLASS MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering the specified glass units that may be incorporated into the Work include, but are not limited to the following:
   1. Oldcastle Building Envelope; https://obe.com
   2. Guardian Glass; https://www.guardianglass.com/us/en
   3. NSG (Pilkington); https://www.pilkington.com/
   4. Viracon; https://www.viracon.com/

2.04 MONOLITHIC FLOAT-GLASS UNITS

A. Uncoated Clear Float-Glass Units: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements. Provide Kind FT (fully tempered) float glass where indicated or, if not indicated, where required by authorities having jurisdiction.

2.05 DOOR GLASS LITES

A. Non-rated doors: Provide clear or tinted laminated glass in sizes as noted on the door schedule. Wire glass is not allowed.

B. Rated doors: Provide clear or tinted laminated glass of size and type as allowed by code and indicated on door schedule which will achieve required door rating. Wire glass is not allowed in doors or sidelights.

2.06 INSULATING-GLASS UNITS

A. Solar-Control (Tinted) Low-E insulating-Glass Units:

B. Acceptable manufacturers: Refer to Paragraph 2.03

C. Overall Unit Thickness and Thickness of Each Lite: 1” (25mm) and 1/4” (6.0 mm).

D. Interspace Content: Air or inert gas as standard with manufacturer.

E. Outdoor Lite: Class 2 (clear) Kind HS (heat-strengthened) float glass. Provide Laminated Tempered Glass float glass where indicated or, if not indicated, where required by authorities having jurisdiction.

F. Tint Color: as selected by Architect from submitted samples.

G. Indoor Lite: Class 1 (clear) annealed or Kind HS (heat-strengthened) float glass where heat strengthening is required to resist thermal stresses induced by differential shading of individual glass lites and to comply with system performance requirements. Provide Laminated Tempered Glass float glass where indicated or, If not indicated, where required by authorities having jurisdiction.

H. Low-E Coating: Sputtered on second surface.

I. Glazing Properties
   1. Visible Light Transmittance (VLT): 35
   2. Visible Light Reflectance Exterior %: 6
   3. Visible Light Reflectance Interior %: 10
   4. (BTU/hr°ft2°˚F) NFRC U-Value: Winter Nightime = .29; Winter Argon = .24
   5. Solar Heat Gain Coefficient (SHGC): .25
   6. Light to Solar Gain (LSG): 1.40

2.07 ACID ETCHED FROSTED GLASS

A. Acid etched float glass: Laminated, translucent glass with a smooth and homogeneous surface.

B. Description:
1. Thickness: 1/4"
2. Light Transmission: 89%
3. Light Reflectance: 8%
4. Total Solar En. Trans.: 88%
5. UV Transmission: 73%

2.07 GLAZING MATERIALS

A. Setting Blocks and Spacers: ASTM C864, semi-hard neoprene or vinyl rubber, 70-90 Shore A hardness when tested in accordance with ASTM D2240, of width equal to thickness of glass and long enough to limit load on each block to 15 pounds per square inch. Minimum length of setting blocks shall be 3 inches.

B. Glazing Gaskets: Continuous, closed-cell, extruded neoprene or vinyl rubber, channel type, manufactured for glazing in type of metal doors and frames indicated, conforming with applicable requirements of ASTM C509. Color shall be as selected by the Engineer from manufacturer's standards. Gaskets shall be capable of being compressed 40 percent of original size and shall have 100 percent recovery capability when tested in accordance with ASTM F36.

C. Glazing Tape: Synthetic rubber sheet or strip material reinforced and stabilized with fabric mesh in center and treated with a bonding agent on both contact surfaces.

D. Glazing Compounds:

1. For Face Glazing: ASTM C669, elastic glazing compound, manufactured for back bedding and face glazing of metal sash, in color as selected by the Engineer from manufacturer's standards.

a. Include window manufacturer's glass-retaining glazing clips for face glazing.

E. Elastomeric Glazing Sealant: Comply with ASTM C 920 and other requirements indicated for each liquid applied chemically curing sealant specified, including those referencing ASTM C920 classifications for type, grade, class and uses related to exposure and joint substrates.

1. Single-Component Neutral and Basic Curing Silicone Sealants:

a. Dow Corning Corp; 790
b. GE Silicone; SilPruf LM SCS2700.
c. Tremco; Spectrum 1 (Basic)

1) Type and Grade: S (single component) and NS (nonsag)
2) Class: 100/50
3) Use Related to Exposure: NT (non-traffic)
4) Uses related to glazing substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

Use O Glazing Substrates: Coated glass; color anodic aluminum; aluminum coated with a high-performance coating; galvanized steel; and wood.

2. Neutral Curing Silicone Glazing Sealants:
   a. Dow Corning Corp. 795
   b. GE Silicones; UltraPruf II SCS2900

   c. Pecora Corp.; 895
      1) Type and Grade: S (single component) and NS (nonsag)
      2) Class: 50
      3) Use Related to Exposure: NT (non-traffic)
      4) Uses related to glazing substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

         Use O Glazing Substrates: Coated glass; color anodic aluminum; aluminum coated with a high-performance coating; galvanized steel; and wood.

3. Class 25 Neutral-Curing Silicone Glazing Sealant:
   a. Dow Corning Corp. 799
   b. GE Silicones; UltraGlaze SSG4000.
   c. Tremco; Proglaze SG
      1) Type and Grade: S (single component) and NS (nonsag)
      2) Class: 25
      3) Use Related to Exposure: NT (non-traffic)
      4) Uses related to glazing substrates: M, G, A, and, as applicable to glazing substrates indicated, O.

         Use O Glazing Substrates: Coated glass; color anodic aluminum; aluminum coated with a high-performance coating; galvanized steel; and wood.

E. Back Bedding Mastic Glazing Tapes: Preformed, butyl based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape. for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape. for glazing applications in which tape is not subject to continuous pressure.

F. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for glazing applications in which tape acts as the primary sealant.
2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.08 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers. and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.09 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to glaze openings indicated for Project with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.

C. Grind smooth and polish exposed glass edges and comers.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:
1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep system.
3. Minimum required face or edge clearances.
4. Effective sealing between joints of glass-framing members.
5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not limited bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.

E. Install setting blocks in sill rabbets sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm) as follows:

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.

2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.

I. Set glass lites in each series with uniform patten, draw, bow, and similar characteristics.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at comers and install gaskets in a manner recommended by gasket manufacturer to prevent comers from pulling away; seal comer joints and butt joints with sealant recommended by gasket manufacturer.

3.04 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.

D. Place joints in tapes at comers of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until just before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at comers and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at comers.

C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weather tight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extending into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.07 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately by method recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION 08 80 00

SECTION 08 88 53 SECURITY GLAZING

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Approved Manufacturers: Subject to compliance with requirements, provide products from one of the following manufacturers:

1. Isoclima Specialty Glass, LLC: Blairsville, PA http://isoclimasg.com/ (866)-412-6977
2. Global Security Glazing Selma, AL: www.security-glazing.com (866)-412-6977

2.02 WARRANTY

A. Manufacturer's Special Warranty for Laminated Security Glass: Manufacturer's standard form in which laminated-glass manufacturer agrees to replace laminated glass that deteriorates within specified warranty period. Deterioration is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation and delamination due to defects in material workmanship.

1. Warranty Period: 5 years from date of Manufacture.

B. Manufacturer's Special Warranty for Insulating Glass: Manufacturer's standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 5 years from date of Manufacture.

2.02 MATERIALS [Security Glazing]

A. Basis of Design: Childgard Security Glazing by Isoclima Specialty Glass, LLC (1-866-412-6977) to meet ASTM F1233 Class 1.4 and/or 5-aa1 for a minimum of 6 minutes of Forced Entry Resistance.

B. Substitutions: Refer to section 01 25 13. Substitutions must provide third party test report indicating compliance with this testing criteria.

2.03 SECURITY GLAZING

A. Tinted, Safety, Impact-Resistant Insulating Low-E, Clear Units: 1-inch thick pre-assembled units consisting of 2 sheets of glazing as specified, enclosing a hermetically sealed dehydrated air spaces; with spacers, sealant, and without protective edge banding. Metal spacers shall by finished to match finish of aluminum frame systems.

1. Interior Pane: Impact-resistant laminated safety glazing with proprietary layup, clear, Condition A (uncoated surfaces), 3/8-inch thick; compliant with ASTM F1233 Level 1.3.
a. Product: Global Security Glazing: Childgard Security Glazing.
b. Air Space-thick: 1/2-inch

2. Exterior Pane: ASTM C 1048, Type I, Class 2 (Tinted Heat-Absorbing and Light Reducing) – Vitro Architectural Glass (formerly PPG Industries, Glass Group): Clear, Quality q3 (Glazing select), Kind FT - Fully Tempered, 1/4-inch thick, Condition C (other coated surfaces).
a. Low-E Coating: Vitro Architectural Glass (formerly PPG Industries, Glass Group): Solarban 90 low-emissivity (sputtered) coating on 2nd surface.

3. Performance Characteristics: Low-E insulating glass shall comply with the following:
a. Solar Heat Gain Coefficient: 0.23
b. Winter U-value: 0.29
c. Visible Transmittance: 51%

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine framing glazing, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass-framing members.

5. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not limited bonded to substrates.

3.03 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

C. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

3.04 CLEANING AND PROTECTION

A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately by method recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

SECTION 09 21 16 GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Description of Work: Work of this section includes, but is not limited to, the following:
1. Gypsum board screw attached to steel framing and accessories
2. Non-load bearing metal studs and furring
3. Metal shaftwall systems
4. Metal suspension systems
5. Sound-rated construction and accessories
6. Water-resistant gypsum backing board
7. Gypsum Sheathing
8. Gypsum board finishing
9. Trim and accessories

1.2 REFERENCES

Commented [GB1]: NOTE: Use applicable editions.

A. AISI S220 – North American Specification for the Design of Cold-Formed Steel Framing – Nonstructural Members."

B. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units.

C. ASTM A 1003/A 1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-formed Framing Members

D. ASTM C 557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Substrates.

E. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

F. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members.

G. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

H. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

I. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board.

J. ASTM C 844 - Standard Specification for Application of Gypsum Base to receive Gypsum Veneer Plaster.

Commented [GB2]: NOTE: ASTM C931 was withdrawn in 2005 and replaced with ASTM C1396.

K. ASTM C1002 - Standard Specification for Steel Self Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

L. ASTM C 1047 - Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.

M. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as

Sheathing.

N. ASTM C 1178/C 1178M - Standard Specification for Glass Mat Water Resistant Gypsum Backing Panel.

O. ASTM C1278/C 1278M - Standard Specification for Fiber Reinforced Gypsum Panel.

P. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board.

Q. ASTM C1513 - Standard Specification for steel Tapping Screws for Cold-Formed Steel Framing Connections.

R. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

S. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

T. ASTM E 413 - Classification for Rating Sound Insulation.

U. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association.

V. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association.

W. GA-600 - Fire Resistance Design Manual; Gypsum Association.

X. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

1.3 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Manufacturer's installation instructions.

B. Certification: Manufacturer's affidavit that materials used contains no asbestos.

C. Evaluation Reports: Submit evaluation reports certified under an independent third-party inspection program administered by an agency accredited by IAS to ICC-ES AC98 accreditation criteria for inspection agencies.

1.4 SYSTEM REQUIREMENTS

A. Performance Requirements: Fabricate and install systems as indicated but not less than that required to comply with ASTM C754 under the following conditions:
1. Gypsum board partitions:
a. Standard systems: Maximum deflection of L/240 of partition height.
b. Systems to receive water resistant gypsum board or backer board: Maximum deflection of L/360 of partition height.
2. Cavity shaflwall systems: Withstand minimum positive and negative pressure of 5 psf.
3. Interior suspended ceilings and soffits: Maximum deflection of L/360 of distance between supports.

4. Exterior soffits (if shown): Withstand minimum positive and negative pressure of 20 psf with maximum deflection of L/360 of distance between supports.
5. TALL WALLS (partitions exceeding 30'-0")
   a. Use double structural studs back-to-back 24 inches on center. Attach studs back to back with screws approximately 4 feet on center.
   b. For 5-psf wind load, provide 20 gauge runner track. Fasteners shall have a capacity of 300 pounds in single shear and bearing.
   c. For 10-psf wind load, provide 18 gauge runner track attached with fasteners with 400 pound single shear and bearing.

B. Fire Resistance Ratings: Where fire resistance classifications are indicated, provide materials and application procedures identical to those listed by UL or tested according to ASTM E119 for type of construction shown.

C. Acoustical Ratings: Where sound ratings are indicated, provide materials and application procedures identical to those tested by manufacturer to achieve Sound Transmission Class (STC) scheduled or indicated in accordance with ASTM E90.

D. Design framing systems in accordance with AISI S220 and ASTM C645, Section 10, unless otherwise indicated.

Commented [GB3]: NOTE: Building code adoption in Texas takes place at the local level. Therefore, . . .

Commented [GB4R3]: For IBC 2012 use ASTM C645.
For IBC 2015 use AISI S220 and ASTM C645, Section 10.
For IBC 2018 use AISI S220

Commented [GB5R3]: For IBC 2015, AISI S220 and ASTM C645, Section 10 applies; except that ASTM C645, Section 10 (the screw penetration test) only applies to studs/track. Otherwise, only AISI S220 applies.

1.5 QUALITY ASSURANCE

A. Reference Standards:
1. Applicable requirements of ASTM C754 for installation of steel framing.
2. Install gypsum board in accordance with applicable requirements and recommendations of Gypsum Association GA 216, "Recommended Specifications for the Application and Finishing of Gypsum Board" except for more stringent requirements of manufacturer.
3. Apply acoustical sealant in accordance with applicable requirements of ASTM C919.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver material to site promptly without undue exposure to weather.

B. Deliver in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

C. Store above ground in dry, ventilated space. Protect materials from soiling, rusting and damage.

D. Store board to be directly applied to masonry walls at 70°F for 24 hours prior to installation.

E. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Framing."

1.7 PROJECT CONDITIONS

A. Do not install gypsum board when ambient temperature is below 40°F. Maintain a uniform temperature in the range of 45°F. to 60°F. Provide ventilation to eliminate excessive moisture.

B. For adhesive attachment of gypsum board, and for finishing of gypsum board, maintain

ambient temperature above 55°F from one week prior to attachment or joint treatment, and until joint treatment is complete and dry.

C. In cold weather, the building shall be heated during application of gypsum board and joint treatment.

1.8 ALTERNATE CONSTRUCTION WASTE DISPOSAL

A. Reuse: Separate clean waste drywall pieces from contaminants for landfilling or recycling. Do not include vinyl-faced, mold-resistant or asphalt impregnated gypsum boards. Pulverize and apply to site soil in accordance to landscape specifications. Protect scrapes and pulverized material from moisture and contamination. Alternate to on-site soil amendment, work to supply local farming granular material for their use.

B. Recycle: Separate clean waste drywall pieces from contaminants for landfilling or reuse. Working with local waste hauler and local drywall manufacturer, provide proper storage of waste for pickup and return. Protect scrapes material from moisture and contamination.

1.9 GENERAL

A. All materials shall be delivered on the job in original unopened containers or bundles and shall be properly stored to prevent damage.

B. Minimum installation and application standards of all materials shall be in accordance with these specifications and the latest printed directions of the manufacturer. Products of the United States Gypsum Co., National Gypsum Co., or approved alternate may be used.

C. Double stud partitions and/or necessary furring shall be provided when required to conceal piping, structural columns and beams, conduit, or other incidental items.

D. Insofar as is possible, use metal framing in lieu of wood for blocking and furring.

E. Framing for exterior metal stud walls shall be according to Specification Section 05 40 00.

1.10 WARRANTY

A. Warrant the work specified for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials or workmanship.

B. In addition, provide warranty from the manufacturer for the following products:
1. Exterior sheathing weathering warranty covering in-place exposure damage to exterior sheathing for twelve (12) months.
2. Exterior sheathing warranty against manufacturing defects for five (5) years.
3. Abuse Resistant Panel weathering warranty covering in-place exposure damage to sheathing for six (6) months.
4. Abuse Resistant Panel warranty against manufacturing defects for three (3) years.
5. Glass-mat sheathing weathering warranty covering in-place exposure damage to sheathing for three (3) months.
6. Glass-mat sheathing warranty against manufacturing defects for three (3) years.
7. Tile backer board warranty against manufacturing defects for 20 years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers listed whose product meets or exceed the specifications may be used on the Project. Other manufacturers must have a minimum of five (5) years' experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions in order to be considered.

1. Gypsum Board and Related Products:
   a. G-P Gypsum Corp.
   b. Gold Bond Building Products Div., National Gypsum Co.
   c. Lafarge Gypsum
   d. United States Gypsum Co.
   e. Waterguard USA

2. Steel Framing and Furring:
   a. California Expanded Metal Products
   b. CLARKWESTERN Dietrich Building Systems
   c. MarinoWare; a Division of Ware Industries
   d. Phillips Manufacturing Co
   e. SCAFCO Corporation

3. Aluminum Moldings:
   a. Fry Reglet Corporation
   b. MM Systems Corporation

2.2 STEEL FRAMING CEILINGS AND SOFFITS

A. Comply with ASTM C 754 for materials and sizes, unless otherwise indicated.
1. Protective Coating: Comply with AISI S220 ASTM A653/A653M, G40 (Z120) or equivalent corrosionresistance. A40 galvannealed products are not acceptable.
   a. Coating shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Hanger and Tie Wire: ASTM A 641, Class 1 zinc-coating, soft temper.

C. Hanger Rods: Mild steel, zinc coated.

D. Flat Hangers: Mild steel, zinc coated.

E. Angle-Type Hangers: Angles with legs not less than 7/8 inch wide, formed from 0.0296 inch thick galvanized steel sheet per ASTM A 653, G 60 coating, with bolted connections and 5/16 inch diameter bolts.

F. Carrying Channels: ASTM C 754, shall be cold-formed from steel with a 0.0538 inch (1.37 mm) minimum base metal thickness and 1/2 inch (12.7 mm) wide flanges, as follows:
1. Depth: 1-1/2 inches or other as noted on the drawings

G. Steel Studs for Furring Channels: AISI S220 and ASTM C645, Section 10.
1. Subject to compliance with requirements, provide ClarkDietrich; ProSTUD 25 gauge-equivalent (0.0150 inch) with Smart Edge technology, or comparable product.
2. Depth: 1-5/8 inches or other as noted on the drawings

Commented [GB6]: NOTE: BPB is now known as CertainTeed Gypsum.

Commented [GB7]: NOTE: Temple-Inland is now part of G-P Gypsum.

Commented [GB8]: NOTE: Commonly known as ClarkDietrich.

Commented [GB9]: NOTE: Consolidated Systems is no longer doing business.

Commented [GB10]: NOTE: Dietrich Metal Framing is now known as ClarkDietrich.

Commented [GB11]: NOTE: ASTM C754 is the installation standard.

Commented [GB12]: For IBC 2012 use ASTM C645. For IBC 2015 and 2018 use AISI S220.

Commented [GB13]: NOTE: ASTM C754 is the installation standard.

Commented [GB14]: NOTE: ClarkDietrich no longer manufactures UltraSTEEL products.

Commented [GB15]: NOTE: A traditional 25 gauge thickness (0.0179 inch) (18 mil) has 33 ksi, whereas our 25EQ (ProSTUD 25) has a 50 ksi.

Commented [GB16]: NOTE: ProSTUD 25 (0.015 inch -- 0.38 mm) (50 ksi) is equivalent to conventional 0.0179 inch (33 ksi).

H. Hat-Shaped, Rigid Furring Channels: AISI S220, hat-shaped, depth of 7/8 inch or other as noted on the drawings.
1. Subject to compliance with requirements, provide ClarkDietrich; Hat-Shaped, Rigid Furring Channels, or comparable product.

I. Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet per AISI S220 to form 1/2 inch deep channel of the following configuration:
1. Subject to compliance with requirements, provide ClarkDietrich; Resilient Channel RCSD.
2. Single Leg Configuration: Asymetric-shaped channel with face connected to a single flange by a single-slotted leg.

J. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and interlocking cross furring members.
1. Products: Subject to compliance with requirements, provide the following:
a. Armstrong World Industries, "Furring Systems/Drywall".
b. Chicago Metallic Corp. "Drywall Furring 640 / Drywall Furring 660".
c. USG Interiors, Inc. "Drywall Suspension System".

2.3 STEEL FRAMING FOR WALLS AND PARTITIONS

A. Provide steel framing members complying with the following:
1. Protective Coating: AISI S220, G40 (Z120), or equivalent corrosion resistance. A40 galvannealed products are not acceptable.
a. Coating shall demonstrate equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Steel Studs and Runners: AISI S220 and ASTM C645, Section 10.
1. Subject to compliance with requirements, provide ClarkDietrich; ProSTUD 25 gauge-equivalent (0.0150 inch) with Smart Edge technology, or comparable product.
2. Depth: As indicated on Drawings

C. Hat-Shaped Rigid Furring Channels: AISI S220, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:
1. Subject to compliance with requirements, provide ClarkDietrich; Furring Channel, or comparable product.
2. Depth: 7/8" or as indicated on Drawings.

D. Resilient Furring Channels: Manufacturer's standard product designed to reduce sound transmission, fabricated from steel sheet per AISI S220 to form 1/2 inch deep channel of the following configuration.
1. Subject to compliance with requirements, provide ClarkDietrich; Resilient Channel RCSD.
2. Single Leg Configuration: Asymetric-shaped channel with face connected to a single flange by a single-slotted leg.

E. Single Long-Leg Runner System: Manufacturer's top runner complying with AISI S220, with 2-inch (50.8 mm) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging or cold rolled channel with clip angles or ClarkDietrich Spazzer® 9200 Bridging and Bracing Bar located within 12 inches (305 mm) of the top of studs to provide lateral bracing.

F. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
   1. Subject to compliance with requirements, provide ClarkDietrich; MaxTrak Slotted Deflection Track, or a comparable product or field assembled standard top track assembly compliant with movement requirements

Commented [GB17]: NOTE: Dietrich Metal Framing (now known as ClarkDietrich) no longer manufactures SLP-TRK.

G. Firestop Track: Top runner designed to allow partition had to move while maintaining integrity of assembly fire-resistance rating. Thickness not less than indicated for studs, and of width to accommodate depth of studs.
   1. Subject to compliance with requirements, provide ClarkDietrich; BlazeFrame® (DSL2) Slotted Deflection Track, or a comparable product. OR
   2. Field assembled standard top track assembly with appropriate fire protection and UL assembly classification.

H. Z-Shaped Furring Members: Manufacturer's standard Z-shaped furring members with slotted or nonslotted web, with minimum base metal (uncoated) thickness of 0.0179 inch, face flange of 1-1/4 inch, wall attachment flange of 3/4 inch, and of depth required to fit installation thickness indicated.
   1. Subject to compliance with requirements, provide ClarkDietrich; Z-Furring Channel or comparable product.

I. Flat Strap and Backing Plate: Sheet for blocking or bracing in length and width as indicated, and with minimum base metal (uncoated) thickness as follows:
   1. Thickness: As indicated on Drawings or as required if not shown.
   2. Subject to compliance with requirements, provide ClarkDietrich; Danback Fire Treated Wood Backing Plate D16F or Danback Fire Treated Wood Backing Plate D24F.

J. Channel Bridging: 0.0538 inch base metal thickness, with minimum 1/2 inch wide flanges
   1. Subject to compliance with requirements, provide ClarkDietrich; Spazzer® 9200 Bridging and Spacing Bar
   2. Subject to compliance with requirements, provide ClarkDietrich; EasyClip™ U-Series Clip Angle U543 but not less than 1-1/2 by 1-1/2 inches, 0.0538 inch thick, galvanized steel.

K. Header/Sill System: Preformed, pre-engineered header/sill, minimum 20 gage, galvanized sheet steel for use at openings in metal stud wall systems.
   1. Manufacturer: Subject to compliance with requirements, provide products by the following: Brady Construction Innovations, Inc. "Pro X Header" OR ClarkDietrich; ClarkDietrich; RedHeader PRO.

L. Column and Beam Wrap Fastener: SNAP-ON WALLBOARD CLIP as manufactured by Claw International, 5309 Hwy. 75 North, Suite 112 - Sioux City, IA 51108; Telephone: (712) 239-7200; Fax: (712) 239-1196; website: www.theclaw.net.
   1. The Claw: 1 1/2 inch thick x 2 inch wide x 2 3/8 inch (38 x 51 x 60 mm) long, galvanized steel, snap-on clip.
   2. Support Angle: 25 gauge (No. 25 MSG) (0.0209 inch (0.531 mm) thick) galvanized steel angle with 1 1/2 inch (38 mm) legs. Length: 1 inch (25.4 mm) shorter than assembly length.

3. Screws: 1 inch (25.4 mm) and 1 5/8 inch (41 mm) self-drilling, self-tapping, Type 'S' steel.

4. Corner Bead: 26 gauge (No. 26 MSG) (0.0179 inch (0.455 mm) thick) galvanized steel angle with 1 1/4 inch (32 mm) legs.

5. Nails: 4d x 1 3/8 inch (35 mm) long.

M. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power and other properties required to fasten steel framing and furring member securely to substrates involved; comply with recommendations of gypsum board manufacturers for applications indicated.

N. (If indicated as required), Breakaway (Meltaway) Fire Wall Anchors: For double wall fire wall construction where IBC Section 706 requires fire walls to allow collapse of construction on either side without collapse of the wall. Anchors attaching the fire wall to CMU, concrete or steel must have the capability of providing structural performance, but "detach" during a fire.

1. All breakaway anchors shall be constructed of rolled zinc alloy 710 and have a melting point of 792 degrees.

2. Approved anchors shall be equal to Heckmann Breakaway Fire Wall Anchors #187, 274,189, 341-B, 394,196.

3. OPTION: ClarkDietrich aluminum breakaway clips, Aluminum Burn Clip (AB), are used as part of the H-Stud Area Separation Wall assembly, holds the Area Separation Wall assembly in place at the floor roof and truss line between adjacent units, and are designed to melt and break away when exposed to fire.

2.4 GYPSUM BOARD

A. **General**: Provide gypsum board of types indicated in maximum lengths available to minimize end-to-end butt joints.
1. Thickness: Provide gypsum board in thickness indicated, or if not otherwise indicated, in 5/8 inch thickness.
2. Provide Abuse-Resistant Gypsum Wallboard at ALL corridor, lobby or other "public" locations with gypsum board partitions below 8'-0" A.F.F., minimum.

B. **Gypsum Board**: USG 5/8" thick "Fire Code" Core Gypsum Panel, Type X (ASTM C 1396), SW, with U.L. rating and tapered edges. Provide panels 48" wide and in lengths as long as practical to minimize the number of joints. Metal stud partitions in all areas not mentioned below shall receive Gypsum Board. Provide Sag-resistant type for ceiling surfaces.

C. **Gypsum Backing Board for Multi-Layer Applications**: ASTM C 1396 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 1396, of type, edge configuration and thickness indicated below, in maximum lengths available to minimize end-to-end joints. Type X for fire-resistant rated assemblies and where indicated. Sag-resistant type for ceiling surfaces. Edges: Square, non-tapered, or V-tongue and groove. Thickness: 1/2" and 5/8", unless otherwise indicated.

Commented [GB18]: NOTE: ASTM C442 was withdrawn in 2005 and replaced by ASTM C1396.

D. **Abuse-Resistant Gypsum Wallboard**: ASTM C 1278/C 1278M and ASTM C 1396, of types, edge configuration and thickness indicated below without paper facing and with fiber mesh reinforced backing; in maximum lengths available to minimize end-to-end butt joints. Types: Regular, unless otherwise indicated. Thickness: 5/8", unless otherwise indicated.
1. Manufacturer: Subject to compliance with requirements, provide products by the the following: USG "Fiberock VHI Abuse-Resistant Gypsum Fiber Interior Panels" or USG "Mold Tough AR Firecode Core"

E. **Tile Backer Board in ALL WET AREAS**: Dens-Shield Tile Backer by Georgia Pacific or Fiberock Tile Backer by USG in compliance with ASTM C-1178 meeting mold-mildew-fungus resistance test ASTM D3273-94 with performance rating of 10. Provide panels 48" wide and in lengths as long as practical to minimize the number of joints. Metal stud partitions in areas where walls are likely to get wet shall receive Tile Backer Board. Metal stud partitions with ceramic tile in areas where walls are likely to get wet shall also receive Tile Backer Board. Examples of rooms or areas requiring Tile Backer Board include, but are not limited to: restrooms, janitor closets (within 4'-0" of mop sink), behind sinks, drinking fountains (min 2'-0" beyond each edge and above rim) showers and any other similar wet area or wet area with ceramic tile.

F. **NON-WET AREAS:** All gypsum board in the project, not specified to be in installed in a WET AREA, shall be Moisture and Mold Resistant Gypsum Board: USG 5/8" Mold Tough "Fire Code" Core Gypsum Panel, Type X (ASTM C1396), SW, with UL rating. Provide panels 48" wide and in lengths as long as practical to minimize the number of joints.

G. **Gypsum Sheathing (Exterior wall sheathing)**: Fiberglass-Faced "Greenglass", 5/8", Type X (ASTM E119) as manufactured by Temple-Inland, "Dens-Glass Gold" glass mat gypsum sheathing board, 5/8" (ASTM C1177) or Securock Glass-Mat Sheathing as manufactured by U.S. Gypsum.

2.5 PARTITION CLOSURES

A. Provide extruded aluminum adjustable partition closures at all junctures of partitions with other construction as indicated.

B. Adjustable partition closures shall be spring loaded assemblies filled with acoustical batt insulation and with finish to match curtain wall system.

C. Manufacturers: Subject to compliance with requirements, provide the following: Gordon Inc., "Mullion Mate".

2.6 PARTITION END CAPS

A. Provide extruded aluminum partition end caps at all partition termination ends.

B. Provide at locations of all adjustable partition closures and other locations indicated. Finish to match curtain wall system.

C. Manufacturers: Subject to compliance with requirements, provide the following: Gordon Inc., "Series 910 Special Shapes".

2.7 PREFORMED NICHES

A. Provide preformed recessed wall niches, ready to receive tile finish specified.
   1. Size: 12 inches by 12 inches by 3-1/2 inches deep, square shape, unless otherwise indicated.
   2. Provide one (1) niche at each shower, whether shown on Drawings or not, and other locations as indicated. Gang showers shall receive one (1) niche per each shower head.
   3. Each location shall be coordinated with Architect in field prior to installation.

B. Manufacturers: Subject to compliance with requirements, provide the following: Noble Company "Pro Form".

2.8 TRIM ACCESSORIES

A. Provide manufacturer's standard trim accessories for gypsum board work, per ASTM C 1047. Provide with either knurled or perforated expanded flanges for nailing or stapling, and beaded for concealment of flanges, in joint compound.

B. Interior Trim Accessories: Provide corner beads, L-type edge trim-beads, U-type edge trim-beads, special L-kerf-type edge trim-beads, and one-piece control joint beads complying with the following requirements.
1. Materials: Formed metal complying with the following requirements.
   a. Sheet steel zinc coated by the hot dip process.
   b. Sheet steel zinc coated by the hot dip process or electrolytic process, or sheet steel coated with aluminum.
2. Shapes: As indicated below by reference to Figure 1 designations per ASTM C 1047.
   a. Corner bead on outside corners, unless otherwise indicated.
      1) Product: ClarkDietrich; 103 Deluxe Cornerbead or comparable product.
   b. L-bead with both face and back flanges; face flange formed to receive joint compound. Use L-beads for edge trim, unless otherwise indicated.
      1) Product: ClarkDietrich; Metal U-Trim M20A or comparable product.
   c. L-bead with face flange only; face flange formed to receive joint compound.
      1) Product: ClarkDietrich; Metal L-Trim M20B or comparable product.
   d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
      1) Product: ClarkDietrich; Metal J-Trim M400 Series or comparable product.
   e. One piece control joint formed with V-shaped slot and removable strip covering slot opening.
      1) Product: ClarkDietrich; #093 Control Joint or comparable product.
3. Reveals: Extruded aluminum.
   a. Products: Fry Reglet Corporation "No. DRM-50-625".

C. Exterior Surface Trim and Accessories: Cornerbead, edge trim, control joints formed from sheet steel zinc coated by the hot dip process per ASTM C 1047, in shapes indicated below by reference to ASTM C 1047, Figure 1 Designations.
1. Cornerbead on outside corners, unless otherwise indicated.
   a. Product: ClarkDietrich; 103 Deluxe Cornerbead or comparable product.
2. Edge trim complying with shape LC-bead per Figure 1, unless otherwise indicated.
   a. Product: ClarkDietrich; Metal U-Trim M20A or comparable product.
3. One piece control joint formed with V-shaped slot and removable strip covering slot opening.
   a. Product: ClarkDietrich; #093 Control Joint or comparable product.

D. Exterior Surface Trim and Accessories: Cornerbead, edge trim, control joints formed from PVC conforming to ASTM D 1784.

1. Shapes: As indicated below by reference to Figure 1 designations per ASTM C 1047.

a. Cornerbead on outside corners, unless otherwise indicated.

1) Product: ClarkDietrich; Vinyl Corner Bead or comparable product.

b. Edge trim complying with shape LC-bead per Figure 1, unless otherwise indicated.

1) Product: ClarkDietrich; Vinyl "J" Beads or comparable product.

c. One piece control joint formed with V-shaped slot and removable strip covering slot opening.

1) Product: ClarkDietrich; Vinyl 093 Control Joint or comparable product.

2. Manufacturers:
a. Alabama Metal industries Corp. (AMICO).
b. Plastic Components, Inc.
c. ClarkDietrich.

E. Soffit Reveals: Prefabricated, extruded aluminum reveals.
1. Manufacturer: Subject to compliance with requirements, provide the following: Fry Reglet Corp. "No. DRM-635-50".

F. Soffit Vents: Prefabricated, extruded aluminum soffit vent, with clear anodized finish.
1. Manufacturer: Subject to compliance with requirements, provide the following: Fry Reglet Corp. "Soffit Vent No. DCS-50-V-200".

H. BOTTOM OF DRYWALL PARTIONS

1. Drywall Moisture Protection Devices for bottom of drywall partitions

a. PVC Water Protection Device installed at floor level of drywall partitions as manufactured by Waterguard-USA.
1. www.Waterguard-USA.com or www.KeepsDrywallDry.com
2. Phone number: (800-653-8785)

b. Sizes available:
i. Non-Rated Walls
½" tall extruded PVC GDW moisture guard: installed continuously at floor level of all GDW throughout building.

ii. 1-Hour Fire Rated Walls
1/2" tall extruded PVC GDW moisture guard: installed continuously at floor level of all 1-Hour Fire Rated walls.

iii. 2-Hour Fire Rated Walls
1/2" tall extruded PVC GDW moisture guard: installed continuously at floor level of each layer of GDW on all 2-Hour Fire Rated walls. Once the wall assembly is constructed, place a bead of caulk (latex, acrylic, silicone, polymer, or similar materials-not necessarily listed "fire caulk") at floor level against the outer most layer of moisture guard.

2.9 JOINT TREATMENT MATERIALS

A. General: ASTM C 475; type recommended by manufacturer of sheet products and joint treatment materials for application indicated, unless indicated otherwise.

B. Joint Tape: Paper reinforcing tape.
1. Interior Gypsum Board: Paper reinforcing tape.
a. Product: ClarkDietrich; Strait-Flex Butt-Tape, or comparable product.
2. Exterior Gypsum Board: Paper reinforcing tape.
a. Product: ClarkDietrich; Strait-Flex Butt-Tape, or comparable product.
3. Mold and Mildew Resistant Backer Board: Glass mesh tape.

C. Setting Type Joint Compound: Factory prepackaged, job mixed chemical-hardening powder products for bedding and filling, formulated for uses indicated.
1. For taping and filling only.
2. For prefilling gypsum board joints.
3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile.
4. For filling joints and treating fasteners of mold and mildew resistant backing board behind base for ceramic tile.
5. For filling joints and treating fasteners of gypsum base for veneer plaster.
6. For topping compound, use sandable formulation.

D. Drying-Type Joint Compounds: Factory prepackaged vinyl-based products complying with the following requirements for formulation and intended use.
1. Ready-Mix Formulation: Factory-mixed product.
2. All-purpose compound formulated for use as both taping and topping compound (use for finish (third) coat only.)

E. Exterior Joint Compound: Special chemical-hardening-type for exterior application.

2.10 ACOUSTICAL SEALANT

A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements.
1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.

B. Products: Subject compliance with requirements, provide products by the following:
1. Acoustical Sealant for Exposed and Concealed Joints:
a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
b. Tremco Acoustical Sealant; Tremco, Inc.
c. Sheetrock Acoustical Sealant; United States Gypsum Corp.

2.11 MISCELLANEOUS MATERIALS

A. General: Provide auxiliary materials for gypsum board work of type and grade recommended by gypsum board manufacturer.

B. Laminating Adhesive: Special adhesive or joint compound specifically recommended for laminating gypsum boards.

C. Spot Grout: ASTM C 475, setting-type joint compound for type recommended for spot grouting hollow metal door frames.

D. Gypsum Board Screws: ASTM C 1513
   1. Fastening gypsum board to steel members less than 0.033 inch thick.
   2. Fastening gypsum board to gypsum board.

E. Steel Drill Screws: ASTM C 1513, for fastening gypsum board to steel members.

F. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing), unfaced mineral fiber blanket insulation in thicknesses shown.
   1. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.

G. Thermal Insulation: Material indicated below, of thickness and width to fill voids formed by Z-furring members:
   1. Unfaced Mineral Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing), in thicknesses shown. Mineral-Fiber Type: Fibers manufactured from glass, slag wool, or rock wool.
   2. Extruded Polystyrene Board Insulation: ASTM C 578, Type IV, rigid, cellular, polystyrene thermal insulation formed from polystyrene resin using an extrusion process.

H. Isolation Strip at Exterior Walls:
   1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), non-perforated.
   2. Foam Gasket: Adhesive backed, closed cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

I. Access Doors: If not specified elsewhere, Inryco/Milcor Style DW, size 14" x 14" in walls and 22" x 22" in ceilings. Baked enamel prime coat. Contractor to finish paint (spec. section 09 90 00). Concealed spring hinges. Flush, screwdriver operated steel cam lock. Door shall be manufactured with drywall bead attached.

PART 3 - EXECUTION

3.1 GENERAL / EXAMINATION

A. Examine substrates to which gypsum board construction attaches or abuts, installed hollow metal frames, cast-in anchors and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of gypsum board assemblies specified in this Section.

B. Interior gypsum wallboard and ceiling board installation may not commence until all exterior dampproofing and roofing are completed and roof top equipment is fully installed and flashed and exterior wall openings are protected.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

D. Protect gypsum products from moisture and contaminants. Do not store near materials that may offgas harmful voes.

E. Protect workers, building occupants, and HVAC systems from gypsum dust to maintain construction Indoor Air Quality Management Plan.

3.2 INSTALLATION OF STEEL FRAMING, GENERAL

A. Steel Framing Installation Standard: Comply with ASTM C 754.

B. Install supplementary framing, blocking and bracing at terminations in work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, door bumpers, furnishings and similar construction to comply with details indicated and with recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook", published by United States Gypsum Co.

C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on drawings.
   1. Where suspended ceiling assemblies abut building structure horizontally at ceiling perimeters or penetrations of ceiling.
   2. Where partition and wall framing abut overhead structure.
      a. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

D. Do not bridge building expansion and control joints with steel framing or furring members, independently frame both sides of joints with framing or furring members or as indicated.

3.3 INSTALLATION OF STEEL FRAMING FOR CEILINGS AND SOFFITS

A. Suspend ceiling hangers from building structural members and as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum not part of supporting structural or ceiling suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying or other equally effective means.
   2. Where widths of ducts and other construction within ceiling plenum produce hanger spacings that interfere with the location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
   3. Secure wire hangers to structure, by looping or wire tying, directly to supporting structure, including intermediate framing members. Attach to inserts, eye screws, or other devices appropriate for structure to which hangers are attached as well as for type of hanger involved, in manner that will not cause deterioration or failure, due to age, corrosion or elevated temperatures.
   4. Do not attach hangers to metal roof deck or metal deck tabs.
   5. Do not connect or suspend steel framing from ducts, pipes or conduits.

B. Keep hangers and braces 2 inches clear of ducts, pipes and conduits.

C. Sway-brace suspended steel framing with hangers used for support.

D. Install suspended steel framing components in sizes and at spacing indicated, but not less than required by referenced steel framing installation standard.
   1. Wire Hangers: 0.1620 inch diameter (8 gage), 4 fl. o.c.
   2. Carrying Channels (Main Runners): 1-1/2 inch, 4 fl. o.c.
   3. Rigid Furring Channels (Furring Members): 16 inches o.c.

E. Installation Tolerances: Install steel framing components for suspended ceilings so cross furring members are level to within 1/8 inch in 12 fl. as measured both lengthwise in each member and transversely between parallel members.

F. Wire-tie or clip furring members to main runners and to other structural supports as indicated.

G. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension system abuts vertical surfaces. Mechanically join main beam and cross furring members to each other and butt cut to fit wall track.

H. For exterior soffits, install cross-bracing and additional framing to resist wind uplift.

3.4 INSTALLATION OF STEEL FRAMING FOR WALLS AND PARTITIONS

A. Install runners (tracks) at floors, ceilings and structural walls and columns where gypsum board stud system abuts other construction.
1. Use proprietary tracks for non-rated and fire rated walls and partitions.
2. Install studs full height for all partitions unless noted otherwise.
3. Where studs are installed directly against exterior walls, install asphalt felUfoam isolation strips between studs and wall.

B. Installation Tolerances: Install each steel framing and furring member so that fastening surface does not vary more than 1/8 inch from plane of faces of adjacent framing.

C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at or just above suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
1. Cut studs 1/2 inch short of full height to provide perimeter relief.
2. For STC-rated or fire-resistance rated partitions that extend full height, install framing around structural members, as required to support gypsum board closures needed to make partitions continuous from floor to underside of structure above.
3. Install bridging/spacing bar.

D. Brace partition framing, not extending full height to structure above, with studs same size and thickness as partition framing. Provide bracing at:
1. 6'-0" o.c. intervals along length of partitions.
2. Not less than 6'-0" from partition ends and corners.
3. Door and window openings.

E. Terminate partition framing at suspended ceilings where indicated.

F. Install steel studs and furring in sizes and at spacings indicated.
1. Single-Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.
2. Multiple-Layer Construction: Space studs 16 inches o.c., unless otherwise indicated.

G. Install steel studs with flanges in same direction and leading edge or end of gypsum board panel can be attached to open (unsupported) edges of stud flanges first.

H. Frame door openings to comply with details indicated, with GA-219 and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.

1. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

I. Frame openings other than door openings to comply with details indicated, or if none indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads.

J. Install thermal insulation vertically and hold in place with Z-furring members spaced at 24 inches o.c.
1. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails or screws designed for masonry attachment, spaced at 24 inches o.c.
2. At exterior corners attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation and continue in regular manner.
3. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

3.5 APPLICATION AND FINISHING OF GYPSUM BOARD, GENERAL

A. Gypsum Board Application and Finishing Standards: Comply with ASTM C 840 and GA-216.

B. Install sound attenuation insulation blankets where indicated, prior to gypsum board, unless readily installed after board has been installed on one side.

C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 24 inches in alternate courses of board.

D. Install ceiling boards across framing in manner to minimize end-butt joints, and avoids end joints in central area of each ceiling. Stagger end joints at least 24 inches.

E. Install wall/partition boards in manner to minimize end-butt joints or avoids them entirely where possible. At high walls, install boards horizontally with end joints staggered over studs.

F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

G. Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints.
1. Position boards so like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field-cut ends.
2. Do not place tapered edges against cut edges or ends.
3. Stagger vertical joints over different studs on opposite sides of partitions.

H. Attach gypsum board to steel studs so leading edge or end of each board is attached to open (unsupported) edge of stud flange first.

I. Attach gypsum board to supplementary framing and blocking provided for additional support at openings and cutouts.

J. Spot grout hollow metal door frames for solid core wood doors, hollow metal doors and doors over 32 inches wide except where full grout shown. Apply spot grout at each jamb anchor clip just before inserting board into frame.

K. Form control joints and expansion joints at locations indicated or as recommended, with space between edges of boards, prepared to receive trim accessories.

L. Cover both faces of steel stud partition framing with gypsum board in concealed spaces (above ceiling, etc.), except in chase walls which are braced internally.
1. Except where concealed application is indicated or required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. fl. area, and may be limited to not less than 75 percent of full coverage.
2. Fit gypsum board around ducts, pipes and conduits.

M. Isolate perimeters of non-load-bearing drywall partitions at structural abutments. Provide 1/4 to 1/2 inch space and trim edge with "U" bead edge trim. Seal joints with acoustical sealant unless fire resistant sealant shown.

N. Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and other penetrations with a continuous bead of acoustical sealant. Include a bead of sealant at both faces of partitions.
1. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound flanking paths around or through gypsum board assemblies, including partitions extending above ceilings.

O. Space fasteners in gypsum board in accordance with referenced gypsum board application and finishing standard and manufacturer's recommendations.

P. Space fasteners in panels that are tile substrates maximum 8 inches o.c.

3.6 METHODS OF GYPSUM BOARD APPLICATION

A. Single-Layer Application: Install gypsum wallboard as follows:
1. On ceilings apply gypsum board prior to wall/partition board application to greatest extent possible.
2. On partitions/walls apply gypsum board vertically (parallel to framing), unless otherwise indicated or required by fire resistance rated assembly, and provide sheet lengths which will minimize end joints.
a. On partitions/walls 8'-1" or less in height, apply gypsum board horizontally (perpendicular to framing); use maximum length sheets possible to minimize end joints.
b. At stairwells and other high walls, install gypsum board horizontal, unless otherwise indicated or required for fire resistance rating.
c. On Z-furring, apply gypsum panels vertically (parallel to framing). Locate edge joints over furring member.

B. Double-Layer Application: Install gypsum backing board for base layer and exposed gypsum board for face layer.
1. On ceilings apply base layer prior to application of base layer on walls/partitions; apply face layers in same sequence. Offset joints between layers minimum one stud space. Apply base layers at right angles to supports, unless otherwise indicated.

2. On partitions/walls apply base layer and face layers vertically (parallel to framing) with joints of base layer over supports and face layer joints offset minimum one stud space with base layer joints.

C. Wall Tile Substrates: For substrates scheduled to receive ceramic tile, comply with the following:
1. Install glass-mat, water-resistant gypsum backing board panels to comply with manufacturer's installation instructions at locations scheduled to receive wall tile. Install with 1/4-inch open space where panels abut other construction.

D. Single-Layer Fastening Methods: Apply gypsum boards to metal supports with screws and to wood supports with nails.

E. Double-Layer Fastening Methods: Apply base layer of gypsum board and face layer to base layer as follows:
1. Fasten base layer with screws and face layer with adhesive and supplementary fasteners, except where otherwise required for fire-resistance rated assemblies.

3.7 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. General: Where feasible, use same fasteners to anchor trim accessory flanges as required to fasten gypsum board to supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Install corner beads at external corners, except for walls to receive corner guards.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed. Provide type with face flange to receive joint compound except where "U" bead (semi-finishing type) is indicated.
1. Install "LC" bead where drywall construction is tightly butted to other construction and back flange can be attached to framing or supporting substrate.
2. Install "LK" bead where substrate is kerfed to receive long flange of trim.
3. Install "L" bead where edge trim can only be installed after gypsum board is installed.
4. Install U-type trim where edge is exposed, gasketed or sealant-filled (including expansion joints).

D. Install control joints at locations indicated, or if not indicated, at spacings not greater than 20'-0" centers and locations required by ASTM C 840 and manufacturer's recommendations; and approved by Architect for visual effect.

E. Install reveals at locations indicated on Drawings, whether specifically called out or not. Lines on drawings that are in-plane with the wall shall be considered reveals for bidding purposes and shall be coordinated with Architect prior to beginning wall framing.

F. Install soffit vents at locations indicated.

G. Install “Waterguard” bottom trim on bottom edge of gypboard for all interior partitions as recommended by manufacturer.

3.8 FINISHING OF GYPSUM WALL BOARD

A. General: Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim and control joints; penetrations; fastener heads, surface defects and elsewhere as required to prepare work for decoration.

B. Prefill open joints using setting-type joint compound.

C. Apply joint tape at joints between gypsum boards, except where trim accessories are indicated.

D. Finish interior gypsum wallboard by applying the following joint compounds in three coats (not including prefill of openings in base), sand between coats, and after last coat.
1. Embedding and First Coat: Setting-type joint compound.
2. Fill (Second) Coat: Setting-type joint compound.
3. Finish (Third) Coat: Ready-mix drying all-purpose or topping compound.
4. Textured finishes may be achieved by means of roller texture. Contractor to provide mockup of texture area in small, well lit room for Architect's review and approval prior to installation throughout project.

E. Mold and Mildew Resistant Gypsum Board: Finish using setting type joint compounds to prefill joints and embed tape, for first, fill (second), and finish (third) coats, with last coat being a sandable product. Smooth each coat before joint compound hardens to minimize sanding.

F. Water-Resistant Backer Board Base for Ceramic Tile: Finish joints to comply with ASTM C 840, with gypsum board manufacturer's recommendations, and installation standards referenced in Section 09 31 00 - Ceramic and Quarry Tile.

G. Glass-Mat Water Resistant Backer Board: Comply with glass mat backer board manufacturer's recommendations.

H. Partial Finishing: Omit third coat and sanding on concealed drywall construction indicated for drywall finishing or which requires finishing to achieve fire-resistance rating, sound rating or to act as air or smoke barrier.

I. Levels of Finish: Provide in accordance with Gypsum Association GA 214, "Recommended Levels of Gypsum Board Finish".
1. Level 0 finish: For temporary construction only where gypsum board is scheduled for removal before project completion.
   a. No taping, finishing or accessories required.
2. Level 1 finish: Ceiling plenum areas and concealed areas not visible to view, except provide higher level of finish as required to comply with fire resistance ratings and acoustical ratings.
   a. All joints and interior angles shall have tape set in joint compound. Surface shall be free of excess joint compound. Tool marks and ridges are acceptable.
3. Level 2 finish: All visible areas not receiving paint finish or unconditioned spaces not receiving other finish.
   a. All joints and interior angles shall have tape embedded in joint compound and wiped with a joint knife leaving a thin coating of joint compound over all joints and interior angles.
   b. Fastener heads and accessories shall be covered with a coat of joint compound. Surface shall be free of excess joint compound.
   c. Tool marks and ridges are acceptable.
   d. Joint compound applied over the body of the tape at the time of tape embedment shall be considered a separate coat of joint compound and shall satisfy the conditions of this level.

3. Level 3 finish: Gypsum board substrate at areas to receive textured finishes before painting or areas to receive wall coverings. Do not use for smooth painted surfaces.
   a. All joints and interior angles shall have tape embedded in joint compound and one additional coat of joint compound applied over all joints and interior angles.
   b. Fastener heads and accessories shall be covered with two separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
   c. The prepared surface shall be coated with a drywall primer prior to the application of final finishes.

4. Level 4 finish: All Gypsum board surfaces, to receive flat, eggshell or satin paint, or light texture finish except where another finish level is indicated.
   a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles.
   b. Fastener heads and accessories shall be covered with three separate coats of joint compound. All joint compound shall be smooth and free of tool marks and ridges.
   c. The prepared surface shall be coated with a drywall primer prior to the application of final finishes.

5. Level 5 finish: All gypsum board surfaces to receive gloss, semi-gloss, or enamel finish or where severe lighting conditions occur.
   a. All joints and interior angles shall have tape embedded in joint compound and two separate coats of joint compound applied over all flat joints and one separate coat of joint compound applied over interior angles.
   b. Fastener heads and accessories shall be covered with three separate coats of joint compound.
   c. A thin skim coat of joint compound trowel applied, or a material manufactured especially for this purpose and applied in accordance with manufacturer's recommendations, shall be applied to the entire surface. The surface shall be smooth and free of tool marks and ridges.
   d. The prepared surface be coated with a drywall primer prior to the application of finish paint.

6. For walls scheduled to receive wallcovering, refer to section 09 72 00-Part 3-Execution for preparation requirements of gypsum board.

3.9 CLEANING AND PROTECTION

A. Promptly remove any residual joint compound from adjacent surfaces.

B. Provide final protection and maintain conditions, in manner suitable to Installer, to ensure gypsum board assemblies are without damage or deterioration at time of Substantial Completion.

END OF SECTION 09 21 16

SECTION 09 30 00 TILING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section

B. Related Sections include the following;

1. Division 3 Section Cast-in-Place Concrete for monolithic slab finishes specified for tile substrates.

2. Division 7 Section Joint Sealants for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

3. Division 9 Section "Gypsum Board Assemblies" for cementitious backer units installed in gypsum wallboard assemblies.

1.02 SUMMARY

A. This Section includes the following:

1. Floor tile.
2. Stone thresholds installed as part of tile installations.
5. Wall tile
6. Waterproof membrane for showers & wet areas

1.02 REFERENCES

A. ANSI 118.1 – Dry-Set Portland Cement Mortar
B. ANSI 118.3 – Chemical Resistant, Water Cleanable Tile-Setting & Tile-Grouting Epoxy & Water Cleanable Tile-Setting Epoxy Adhesive
C. ANSI 118.4 – Latex Portland Cement Mortar
D. ANSI 118.5 – Chemical Resistant Furan Mortars & Grouts for Tile Installation
E. ANSI 118.6 – Standard Cement Grouts for Installation
F. ANSI 118.7 – Polymer Modified Grouts for Tile Installation
G. ANSI 118.8 – Modified Epoxy Emulsion Mortar/Grout
H. ANSI 118.10 – Load-Bearing, Bonded, Waterproof Membranes for Thin Set Ceramic Tile & Dimensional Stone Tile
I. ANSI 118.11 – EGP (Exterior Glue Plywood) Latex Portland Cement Mortar
J. ANSI 118.12 – Crack Isolation Membranes for Thin-Set Ceramic Tile & Dimensional Stone Tile
K. ANSI 118.15 – Improved Modified Dry-Set Cement Mortar
L. ANSI 136.1 – Organic Adhesive for Installation of Ceramic Tile
M. ANSI A108.1 – Installation of Ceramic Tile Portland Cement Mortar.
N. ANSI A108.4 – Installation of Ceramic Tile with Organic Adhesives or Water-Cleanable Epoxy Adhesive.
O. ANSI A108.5 – Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex Portland Cement Mortar.
P. ANSI A108.6 – Installation of Ceramic Tile with Chemical Resistant, Water-Cleanable, Tile Setting and Grouting Epoxy.
Q. ANSI A108.8 – Installation of Ceramic Tile with Chemical Resistant Ruran Resin Mortar and

Grout.

R. ANSI A108.9 – Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar and Grout.

S. ANSI A108.10 – Installation of Grout in Tile Work.

T. ANSI A108.11 – Installation of Cementitious Backer Units.

U. ANSI A108.12 – Installation of Ceramic Tile with EGP (Exterior Glued Plywood) Latex-Portland Cement Mortar.

V. ANSI A108.13 – Installation of Waterproof Membranes for Thin-Set Tile and Stone.

W. ANSI A108.14 – Installation of Paper-Faced glass mosaic tile.

X. ANSI A108.15 – Installation of Paper-Faced glass Mosaic Tile — Alternate Method.

Y. ANSI A108.16 – Proposal for Installation of Paper-Faced, Back-Mounted, Edge-Mounted, or Clear Film Face-Mounted Glass Mosaic Tile.

Z. TCNA – Tile Council of North America - Handbook for Ceramic Tile Installation.

AA. ISO 13007 – Standards for Mortar and Grout

1.03 DEFINITIONS

A. Module Size: Actual tile size (minor facial dimension as measured per ASTM C 499) plus joint width indicated.

B. Facial Dimension: Nominal tile size as defined in ANSI A137.1.

1.04 PERFORMANCE REQUIREMENTS

A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
   1. Level Surfaces: Minimum 0.6.
   2. Step Treads: Minimum 0.6.
   3. Ramp Surfaces: Minimum 0.8.
   4. Load-Bearing Performance: For ceramic tile installed on walkway surfaces, provide installations rated for the following load-bearing performance level based on testing assemblies according to ASTM C 627 that are representative of those indicated for this Project: Moderate: Passes cycles 1 through 10.

1.05 SUBMITTALS

A. Product Data: For each type of tile, mortar, grout, and other products specified.

B. Shop Drawings:
   1. Provide tile patterns and locations.
   2. Provide widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.

C. Samples for Verification: Provide samples of each type and composition of tile and for each color and texture required, at least 12 inches square, mounted on braced cementitious backer units, and with grouted joints using product complying with specified requirements and approved for completed work in color or colors selected by Architect for final review. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected. Provide full size units of each type of trim and accessory for each color required.
   1. Provide sample of stone thresholds in 6 inch lengths.
   2. Provide metal edge strips in 6-inch lengths.

D. Product Certificates: Signed by manufacturers certifying that the products furnished comply with requirements.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed tile installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Source Limitations for Tile: Obtain each color, grade, finish. type. composition, and variety of tile from one source with resources to provide products from the same production run for each contiguous area of consistent quality in appearance and physical properties without delaying the Work.

C. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, waterproofer, grout and accessories from a single manufacturer. Provide a complete systems warranty, issued by the tile setting material manufacturer that will cover the entire tile installation system against defects for a minimum ten (10) years

D. Source Limitations for Other Products: Obtain each of the following products specified in this Section from one source and by a single manufacturer for each product:

1. Stone thresholds.
2. Joint sealants.

E. Mockups: Before installing tile, construct mockups for each form of construction and finish required to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for completed Work.

1. Locate mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
2. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
3. Demonstrate the proposed range of aesthetic effects and workmanship.
4. Obtain Architect's approval of mockups before proceeding with final unit of Work.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. When directed, demolish and remove mockups from Project site.
7. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirement of Division 1 Section "Project Meetings."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
B. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

C. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

D. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.08 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturers written instructions.

1.09 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials described below that match products installed, are packaged with protective covering for storage and are identified with labels describing contents.

1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed, for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.01 MANUFACTURERS (Refer to drawings Material Legend for Basis of Design Products)

A. Tile Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Daltile https://www.daltile.com/
2. American Olean https://www.americanolean.com/
3. Crossville Tile https://www.crossvilleinc.com/
4. Interceramic Tile https://interceramicusa.com/
5. Concept Surfaces https://conceptsurfaces.com/
6. Elgin Butler https://elginbutler.com/
7. Trinity Surfaces https://www.trinitysurfaces.com/
8. Arizona Tile https://www.arizonatile.com/
9. BPI https://bpiteam.com/

B. Tile-Setting and Grouting Materials Manufacturers:

1. Custom Building Products www.custombuildingproducts.com/
2. DalTile Corporation www.daltileproducts.com
3. Laticrete International, Inc. www.laticrete.com
4. Mapei Corporation www.mapei.com
5. Ardex www.ardexamericas.com
6. North American Adhesives www.na-adhesives.com

2.02 PRODUCTS, GENERAL

A. ANSI Ceramic Tile and Materials Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.

B. Provide tile complying with Standard Grade requirements, unless otherwise indicated.

C. Colors, Textures, and Patterns: Where manufacturers standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:

1. Match colors, textures, and patterns indicated by referencing manufacturers standard designations for these characteristics.

2. Provide tile trim and accessories that match color and finish of adjoining flat tile.

3. Factory Blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in the factory and package so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples.

D. Mounting: Where factory mounted tile is required, provide back-mounted tile assemblies as standard with manufacturer, unless another mounting method is indicated.

E. Where tile is indicated for installation in wet areas, do not use back mounted tile assemblies unless tile manufacturer specifies that this type of mounting is suitable for these kinds of installations.

F. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating them with a continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

2.03 TILE PRODUCTS

A. Floor Tile: Refer to drawings for Basis of Design products.
1. Substitutions: Refer to section 01 25 13

B. Wall Tile: Refer to drawings for Basis of Design products.
1. Substitutions: Refer to section 01 25 13

C. Trim Units: Provide tile trim units to match characteristics of adjoining flat tile and to comply with the following requirements:
1. Size: As indicated, coordinated with sizes and coursing of adjoining fiat tile where applicable.
2. Shapes: As follows, selected from manufacturers standard shapes
3. Base for Thin-Set Mortar installations: Coved.
4. Wainscot Cap for Thin-Set Mortar installations: Surface aluminum edging strips.
5. Wainscot Cap for Flush Conditions: Regular flat tile for conditions where tile wainscot is shown flush with wall surface above
6. External Corners for Thin-Set Mortar Installations: Surface aluminum edging strips.
7. Internal Corners: Field butted square corners, except with coved base and cap angle pieces designed to member with stretcher shapes.
8. Tapered Transition Tile: Shape designed to effect transition between thickness of tile floor and adjoining floor finishes of different thickness, tapered to provide a reduction in thickness from 1/2 to 1/4 inch across nominal 4 inch dimension.

2.04 STONE THRESHOLDS

A. General: Provide stone thresholds that are uniform in color and finish. Fabricated to sizes and profiles indicated to provide transition between tile surfaces and adjoining finished floor surfaces.

B. Fabricate thresholds to heights indicated, but not more than 1/2 inch (12.7 mm) above adjoining finished floor surfaces, with transition edges beveled on a slope of no greater than 1:2.

C. Marble Thresholds: Provide marble thresholds complying with ASTM C 503 requirements for exterior use and with minimum abrasive-hardness value of 10 per ASTM C 241.

1. Provide white, honed marble complying with the Marble institute of America's Group A requirements for soundness.

2.05 MORTAR BED

A. Rapid-Setting, Pre-Blended, Polymer Modified, Thick-Bed, Sloping Mortar
1. Cleavage Membrane: Asphalt felt, ASTM D 226, Type I (No. 15), or polyethylene sheeting ASTM D 4397, 4.0 mils (0.1 mm) thick.
1. Reinforcing Wire Fabric: Galvanized, welded wire fabric, 2 by 2 inches by 0.062 inch diameter; comply with ASTM A 185 and ASTM A 82, except for minimum wire size.
2. Acceptable mortar bed products are:
   a. Custom Building Products Speed Slope
   b. Laticrete 3701 Fortified Mortar Mix
   c. MAPEI Polyplan RS
   d. North American Adhesives 1300 Magna Float

B. Modified Dry-Set Cement Mortar for small format tile (For tiles with both sides less than 15”): ANSI A118.4, A118.11 and ISO 13007 C2EP1.
1. Approved mortars are:
   a. Custom Building Products Versabond Flex.
   b. Laticrete 252 Gold
   c. MAPEI Ultraflex 2
   d. North American Adhesives 3220 Multiflex Plus

C. Modified Dry-Set Cement Mortar, Non-Sag, for Large and Heavy floor and wall tile installations. (For tiles with at least one side larger than 15”): ANSI A 118.15 and ISO 13007 C2TES1P1.
1. Acceptable mortars are:
   a. Custom Buillding Products Flexbond LFT
   b. Laticrete 254 Platinum
   c. MAPEI Ultraflex LFT
   d. North American 3800 Magna Flex

2.06 GROUTING MATERIALS

A. Latex modified Premium Cement Grout: ANSI A118.7, composed as follows;

1. Factory blended, polymer modified tile grout with fine aggregate for interior or exterior installations.
   a. Dry-Grout Mix: Dry-set grout complying with ANSI A118.7.
   b. Capable of grouting joints from 1/16 inch to ¾ inch
2. Latex Additive: Pre-packaged Acrylic resin powder.
3. Location(s): Anywhere not specified to receive epoxy grout.
4. Approved Cement Grouts:
   a. Custom Prism Sure Color Grout
   b. Laticrete Permacolor Grout
   c. MAPEI Ultacolor Plus FA
   d. North American Adhesives 4800 Evercolor MPG

B. Chemical-Resistant Epoxy Grout: ANSI A118.3, color as indicated.
1. Provide product capable of resisting continuous and intermittent exposure to temperatures of up to 140 deg F (60 deg C), respectively, as certified by mortar manufacturer for intended use.

a. Location(s)
1. Restrooms
2. Showers
3. Kitchen
4. Servery
5. Custodial closets
6. Drinking fountain locations
7. Dressing rooms
8. All wet areas

2. Approved epoxy grout
a. Laticrete SpectraLock Pro Premium Grout
b. Mapei Kerapoxy CQ
c. Custom CEG Lite
d. North American Adhesive 4700 Evercolor IQ

2.07 ELASTOMERIC SEALANTS

A. General: Provide manufacturers standard chemically curing, elastomeric sealants of base polymer and characteristics indicated that comply with applicable requirements of Division 7 Section "Joint Sealants".

B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.

C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and temperature extremes.

D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M. A, and, as applicable to joint substrates indicated, O.

E. Products: Subject to compliance with requirements, provide one of the following:
1. One-Part, Mildew Resistant 100% Silicone Sealants:
a. MAPEI Mapesil T
b. Laticrete Latisil
c. North American Adhesives NA 4200 S
d. Custom 100% Silicone Sealant
2. Multipart, Pourable Urethane Sealants:
a. MAPEI Mapeflex P2 SL

2.08 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement based formulation provided or approved by manufacturer of tile-setting materials for installations indicated. MAPEI Mapecem Quick Patch or North American Adhesives 600 Muilti Patch

B. Metal Edge Strips: Anodized aluminum edge strips as manufactured by Schluter Systems or equal. https://www.schluter.com/ as required by installation configuration or as noted on the drawings with integral provision for anchorage to mortar bed or substrate. Coordinate height of strips with tile thickness. Color to be anodized aluminum unless noted otherwise.

1) Refer to interior elevations for location and type of aluminum edge trim to be used.

C. Temporary Protective Coating: Provide product indicated below that is formulated to protect exposed surfaces of tile against adherence of mortar and grout; is compatible with tile, mortar, and grout products; and is easily removable after grouting is completed without damaging grout or tile.

1. Petroleum paraffin wax, fully refined and odorless, containing at least 0.5 percent oil with a melting point of 120 to 140 deg F (49 to 60 deg C) per ASTM D 87.

D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers. Basis of Design: MAPEI Ultracare Heavy Duty Tile Stone & Grout Cleaner

E. Tile Sealer: Use to seal porous tile or quarry tile before installing epoxy grout. Sealer to be an invisible, penetrating sealer that protects against stains, soiling, discolouration and efflorescence. Sealer to be a clear, non-flammable solution which cures to an invisible water repellant coating. When used on grout joints or porous tile and natural stone, it shall reduce staining and water absorption and shall not noticeably change the color of the tile or grout.

1. Acceptable tile sealers are:
   a. Laticrete “Stonetech Bullet Proof Sealer”
   b. MAPEI Corp; “Ultracare Penetrating Plus Tile Stone & Grout Sealer”
   d. Custom Building Products, “Aqua Mix Sealers Choice Gold”

F. Crack Isolation and Sound Control Membrane:
1. Flexible, thin, load-bearing, fabric reinforced, 'peel-and-stick' crack-isolation and sound-reduction membrane that requires primer complying with ANSI A118.12 ;
   The following products and manufacturers are acceptable:
   a. Basis of Design: MAPEI, "Mapeguard 2". Requires “MAPEI SM Primer”.
   b. Dal-CIM 500 EX manufactured by Dal-Tile.
   c. Crackbuster manufactured by Custom Building Products.
   d. Fracture Ban 90 manufactured by Laticrete
   e. 1550 Crack Isolation membrane by North American Adhesives

2. Professional Crack-Isolation Membrane; premixed, liquid-rubber, quick-drying crack-isolation membrane for installation under tile in residential and commercial interior and exterior environments meeting ANSI A118.12 requirements, provides up to 1/8" (3 mm) of in-plane crack isolation, and dries after about 30 to 50 minutes.
   The following products and manufacturers are acceptable:
   a. Basis of Design: MAPEI, “Mapelastic CI”
   b. Blue 92 manufactured by Laticrete International, Inc.
   c. Fracturefree manufactured by Custom Building Products
   d. 1640 Crack Isolator manufactured by North American Adhesives

F. Expansion Joint:
1. Filler: Flexible and compressible, closed-cell type, rounded at surface to contact sealant as instructed by sealant manufacturer to suit intended use.
2. Typical Conditions except as specified below: Silicone compound sealant over filler. ASTM C920, Uses M and A, single component, mildew resistant. Sanded to match grout. Provide at all wall corners, ceilings, control joints and changes in materials, where floor tile abuts perimeter walls, curbs, columns, and pipes; and 24 feet to 36 feet elsewhere.

3. Conditions exposed to chemicals, food processing, etc.: Polysulfide sealant over filler. ASTM C920, Grade P, Class 25, Uses T and M. Mapeflex P1 SL, or Architect approved equal. Self-leveling and flexible sealant over filler of type instructed by manufacturer to suit application. Sealant shall match grout color. Expansion joints shall conform to TCNA EJ171.

2.09 WATERPROOF MEMBRANE & SHOWER ACCESSORIES

A. Waterproof membrane: To be installed in floor and walls at all showers.

B. References

1. ANSI A108.13 Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone. ANSI A118.10 Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone.

2. ASTM C-627 - Evaluating Ceramic Floor Tile Installation Systems Using the Robinson-Type Floor Tester.

C. Quality Assurance

1. Use qualified workers thoroughly skilled and experienced in current ANSI A108 standards and Tile Council of America (TCNA) recommendations.

D. Submittals

1. Product Data: Submit manufacturer’s technical information and installation instructions for materials required.

E. Project Conditions

1. Comply with bonding agent manufacturer's recommended procedures for hot or cold weather.

F. Membrane System

1. Basis of Design: USG Durock Brand Waterproofing Membrane composed of composite cross laminated HDPE waterproof membrane and vapor retarder.
   a. Thickness: 12 mil.
   b. Roll Length: 25 feet .
   c. Roll Width: 36 inches.
   d. Perm Rating (per ASTM E96): less than 0.075.
   e. Waterproofing Accessories
      1) USG Durock Shower System Waterproof Inside Corner (6”x7”)
      2) USG Durock Shower System Waterproof Outside Corner (6”x7”)
      3) USG Durock Brand Waterproofing Membrane Band 5” x 50”
      4) USG Durock Brand Shower System Waterproof Pipe Seal 8”
      5) USG Durock Brand Shower System Waterproof Mixing Valve Seal 10”

2. Wall and Floor application: Reference installation literature for USG Durock™ Brand Shower System for complete wall and flooring installation requirements.

3. Shower Kits
   a. Equal to shower kit by USG Durock Brand Shower System
   b. Approved Alternate shower kit by Schulter Systems.

4. Acceptable options for a membrane system: Thin, Flexible Polyethylene Sheet Membrane - Nonwoven, polypropylene fabric on both sides, used for both waterproofing and crack isolation in interior/exterior residential and commercial applications Conforms to Thin-Bed waterproof membrane standard ANSI A118.10. Meets Heavy Duty Service requirements per ASTM C-627.
   a. MAPEI Mapeguard WP 200
   b. Laticrete HydroBan Sheet

G. Inspection

1. Examine substrates to verify they are ready to receive tile and membrane with no deficiency that could result in a potentially defective installation. Prepared substrates to be in accordance with ANSI A108, A3.1 and Tile Council of America (TCNA) recommendations.

H. Installation
1. Install membrane and tile per ANSI A108.13, ANSI requirements for thin-set methods and manufacturer's printed instructions.
2. Install membrane with products or methods approved in writing by manufacturer when joining, sealing, fastening or adhering sheet membrane.

I. Field Quality Control Water Test
1. Upon completion of work, plug drain or dam areas and fill with water. After 24 hours inspect for leakage. Make necessary adjustments to stop leakage and re-test until watertight.

J. Protection: Protect membrane from pedestrian or vehicular traffic and prolonged exposure to sunlight.

2.10 MIXING MORTARS AND GROUT
A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
B. Add materials, water, and additives in accurate proportions. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine substrates, areas, and conditions where tile will be installed, with installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.

B. Verify that substrates for setting tile are firm, dry, clean, free from oil, waxy films and curing compounds and within flatness tolerances required by referenced ANSI A108 series of tile installation standards for installations indicated.

C. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

D. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust latter in consultation with Architect.

E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove coatings, including curing compounds, and other substances that contain soap, wax, oil, or silicone and are incompatible with tile-setting materials by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

B. Provide concrete substrates for tile floors installed with latex portland cement mortars that comply with flatness tolerances specified in referenced ANSI A108 series of tile installation standards for installations indicated.

C. Use trowelable leveling and patching compounds per tile-setting material manufacturers written instructions to fill cracks, holes, and depressions.

D. Remove protrusions, bumps, and ridges by sanding or grinding.

E. Blending: For tile exhibiting color variations within the ranges selected during Sample submittals, verify that tile has been blended in the factory and packaged so tile units taken from one package show the same range in colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

F. Field-Applied Temporary Protective Coating: Where indicated under tile type or needed to prevent adhesion or staining of exposed tile surfaces by grout, protect exposed surfaces of tile against adherence of mortar and grout by precoatlng them with a continuous film of a temporary protective coating of Petroleum paraffin wax, applied hot, taking care not to coat unexposed tile surfaces.

G. Install tile sealer for all porous surface tile work to receive epoxy grout.

3.03 INSTALLATION, GENERAL

A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 series of tile installation standards in "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.

B. TCNA Installation Guidelines: TCNA's "Handbook for Ceramic Tile Installation." Comply with TCNA installation methods indicated in ceramic tile installation schedules.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions, unless otherwise Indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces.

E. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints.

F. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

G. Jointing Pattern: Lay tile in grid pattern, unless otherwise indicated. Align joints when adjoining tiles on floor, base, walls, and trim are the same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths, unless otherwise indicated.

H. For tile mounted in sheets, make joints between tile sheets the same width as joints within tile sheets so joints between sheets are not apparent in finished work.

I. Lay out tile wainscots to next full tile beyond dimensions indicated.

J. Provide sealant at interior corners of floor-to-wall, wall-to-wall, and wall-to-ceiling joints.

K. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated, during installation of setting materials, mortar beds, and tile.

L. Do not saw-cut joints after installing tiles.

M. Locate joints in tile surfaces directly above joints in concrete substrates; where substrate materials change; and where floor tile abuts restraining surfaces such as perimeter walls, curbs and columns.

N. Locate joints in field tile at maximum 20'-0" o.c. each way for interior installations. Install control joints in accordance with current TCNA Method EJ171. Provide aluminum edge strips at expansion joints, control joints. and other sealant- tilted joints, and where otherwise indicated.

O. Prepare joints and apply sealants to comply with requirements of Division 7 Section "Joint Sealants."

P. Grout tile to comply with the requirements of the following tile installation standards:

1. For ceramic tile grouts (sand-portland cement, dry-set, commercial portland cement, and latex-portland cement grouts), comply with ANSI A118.1 & 118.4 & 118.15.

2. For chemical-resistant epoxy grouts, comply with ANSI A118.3.

Q. At conditions where tile will be installed over CMU with a bullnose edge, provide grout or other means acceptable to Architect, so that tile is installed on a flat surface.

3.04 FLOOR TILE INSTALLATION METHODS

A. Ceramic Mosaic Tile: Install tile to comply with requirements indicated below for setting bed methods, TCNA installation methods related to types of subfoor construction, and grout types:

1. Latex Portland Cement Mortar/Grout: ANSI A118.4

a. On Ground (ground/1st floor) floors

1). On ground over Concrete Subfloors, Interior: TCNA F-113. – thin-set

2). On ground over gypsum underlayment over Concrete Subfloors, Interior: TCNA F-200. – thin-set w/ membrane

3). On ground Concrete Subfloor, Interior: TCNA F115 – epoxy grout

4) On ground over cementitious self-leveling underlayment over concrete subfloor, Interior: TCNA F205

b. Above Ground (above 1st floor) floors

1). Above ground Concrete Subfloor, Interior: TCNA F125-full w/crack isolation membrane

2). Above ground over gypsum underlayment over Concrete Subfloors, Interior: TCNA F-200A. – thin-set w/ membrane

3). Above ground Concrete Subfloor, Interior: TCNA F115A – epoxy grout

4) Above ground over cementitious self-leveling underlayment over concrete subfloor, Interior: TCNA F205A

B. Tile for Shower Walls and Floors:

1. Shower floor & walls with metal studs, cement or fiber-cement backerboard and mortar bed floor: TCNA B415.

a. Shower floor & walls with metal studs, coated glass mat water-resistant gypsum backerboard and mortar bed floor: TCNA B420.
b. Shower floor & walls with metal studs, coated extruded foam backerboard and mortar bed floor: TCNA B426.

2. Shower floor drain; TNCA B422C

3. Comply with TNCA common shower configuration details for mortar curbs, preformed curbs, solid curbs, shower pan membrane and/or prefabricated shower receptor base.

4. Grout: Chemical resistant epoxy unless otherwise indicated.

3.05 WALL TILE INSTALLATION METHODS

A. Install types of tile designated for wall application to comply with requirements indicated below for setting-bed methods, TCNA installation methods related to subsurface wall conditions, and grout types:

1. Latex Portland Cement Mortar ANSI A108.5.

a. DRY CONDITIONS - TCNA Class Com1 - Metal Studs Interior TCNA W-243 (at dry conditions only, over mold & moisture resistant gypboard)

2. Grout: Latex-portland cement.

b. WET CONDITIONS - TCNA Class Com2 - Metal Studs Interior: TCNA W-244C w/ waterproof membrane (at wet conditions, over cementitious backer board)

1). WET CONDITIONS - TCNA Class Com2 - Metal Studs Interior: TCNA W-244F w/ waterproof membrane (at wet conditions, over fiber cement backer board)

2). WET CONDITIONS - TCNA Class Com2 - Metal Studs Interior: TCNA W-246 w/ waterproof membrane (at wet conditions, over extruded foam backer board)

c. EXTERIOR CONDITIONS - TCNA Class Com6 - Concrete Mason Units Interior: TCNA W-202E (waterproof membrane required for exterior installations)

d. SHOWER W/ PREFAB BASE - TCNA Class Com3 - Shower walls with prefab shower receptor. TNCA B412: Wood or metal studs, cement or fiber cement backer board, waterproof membrane and flexible sealant with chemical resistant epoxy grout.

e. SHOWER W/ SLOPED REINF MORTAR BASE - TCNA Class Com3 – Shower walls with reinforced mortar bed over shower pan membrane. TCNA B415: Wood or metal stud, cement or fiber cement backer board, waterproof membrane, shower pan membrane and sloped to drain reinforced mortar bed and chemical resistant epoxy grout.

3.06 MISCELLANEOUS TILE LOCATION INSTALLATION METHODS (if required by documents)

A. Tile countertops on plywood/MDF underlayment: TCNA C512

B. Tile on metal concrete stairs, metal pan stairs or wood stairs: TCNA S151

C. Tile installed in refrigerator rooms: TCNA R612

3.06 CLEANING AND PROTECTING

A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.

B. Remove latex portland cement grout residue from tile as soon as possible.

C. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturers written instructions, but no sooner than 10 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

D. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

E. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

F. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure tile is without damage or deterioration at the time of Substantial Completion.

G. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.

H. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

I. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION 09 30 00

SECTION 09 51 00 SUSPENDED ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all labor, materials, and equipment to complete all acoustical work in associated systems in accordance with the drawings, schedules and as specified herein.

B. Section includes:
1. Ceiling suspension system
2. Acoustical Ceiling Panels
3. Ceiling Acoustical Diffusers

1.02 GENERAL REQUIREMENTS

A. The installation work shall not start until the building has been completely dried in and all wet work such as concrete, ceramic tile work, plaster, and taping and floating of gypsum board have been completed. A uniform temperature of 60° F. or above shall be maintained during and after installation of the acoustical tile ceilings.

B. Notify the architect of any unsatisfactory conditions on the job site which are considered detrimental to the proper installation of the work.

C. Coordinate and schedule the acoustical work with other trades affected by this. Coordinate the work of this Section for above-ceiling ductwork and for ceiling-mounted air diffusers.

D. Coordinate the work of this Section with the work for above-ceiling electrical conduits and raceways and for ceiling-mounted lighting fixtures and speaker boxes. Particular attention should be given to the mechanical and electrical trades.

E. Accessories and supplementary parts necessary to complete the acoustical ceiling installation shall be included even though not directly shown on the drawings or specified.

F. Replacement Tile: At completion of job, deliver to owner fifty (50) pieces of each ceiling tile used in job for owner's future use. Tile shall be full size and undamaged and still in protective packaging.

G. Ceiling tile installation must carry a 30 year warranty system guarantee against sag, mold, mildew and bacterial growth.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM C635 Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings

2. ASTM C636 Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels

B. Federal Specifications (FS):
1. SS-S-118 Sound Controlling (Acoustical) Tiles and Panels

1.04 SHOP DRAWINGS

A. Reflected ceiling plans are included with the drawings and are intended to establish the basic intention of the design for the ceiling pattern. Any request for variation from the reflected ceiling plans shown on the drawings shall be accompanied by a proposed revised ceiling plan. Variations due to coordination on the job shall not be made without the approval of the architect.

B. Shop Drawings: Submit manufacturer's details and specifications of the ceiling suspension system, including details of anchorage to the structure above and of bracing.

C. Samples: Submit samples and product data of the acoustical panels, suspension system, and accessories. Submit suspension system in 1 foot square package with all components of the system included.

D. Submit all required LEED documentation for mandatory and desirable credits noted in paragraph 1.05 per the submittal requirements outlined in Section 013545.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - GENERAL

A. Ceiling Suspension System: ASTM C635, intermediate -duty, electro-galvanized steel. Type of suspension system, grid size, and finish shall be as indicated. When not indicated, provide Direct Hung Suspension System. Color of finish shall be selected by the Architect from the manufacturer's standard colors. Acceptable manufacturer’s shall be equal to:

1. CertainTeed Architectural
2. USG Donn Brand
3. Chicago Metallic
4. Armstrong World Industries

B. Acoustical Ceiling Panels: Fed. Spec. SS-S-118, Type as indicated, Class A. Light reflectance shall exceed 75 percent. Color, texture, and finish shall be as indicated. When not indicated, provide white, fissured texture acoustical panels. Acoustical ratings shall be as follows unless otherwise indicated: NRC not less than 0.60, CAC not less than 35. Minimum thickness shall be 5/8 inch.
1. CertainTeed Architectural
2. USG Donn Brand
3. Armstrong World Industries

E. Edge Moldings: Armstrong World Industries, Inc.; CertainTeed Architectural; Chicago Metallic; National Rolling Mills; USG; Fry Reglet Corp.

F. Access System: Access shall be such that any panel, anywhere, can be easily removed and reinstalled. System shall be such that panels do not raise or blow out of position from a differential in air pressure.

2.02 MATERIALS

A. Suspension System: Exposed Grid (Typical)

1. Exposed grid systems shall be provided where shown and where scheduled and shall be equal to Prelude 7300 Series XL 15/16” exposed tee grid, 2’ x 2’, intermediate duty, as manufactured by Armstrong Contract Interiors or approved alternate.

a. Approved alternate: CertainTeed 15/16” Classic Stab System Intermediate Duty (EZCS12-12-15)

b. Approved Alternate: USG Donn DX 15/16” Exposed Tee, Intermediated Duty

c. Color to be white unless otherwise noted. Main runners spaced 4’-0” o.c. and cross “T’s” are spaced 2’-0” between main runners. Accessories shall be specifically designed for use with components employed and shall be as recommended by the manufacturer. Hanger wires for main beams shall be #12 gauge, galvanized soft steel. The system shall be of adequate strength to support ceiling loads without sagging and displacing.

B. Ceiling Tile:

1. (SAP-1, SAP-2, SAP-3): Basis of Design Armstrong
Refer to Drawings Material Legend size, color and product type.

2. Substitutions: Refer to section 01 25 13.

3. Refer to section 09 54 23 for Linear Metal Ceilings systems

C. Ceiling Acoustical Diffusers (refer to drawings for locations):
1. “Ceiling Acoustical Diffusers”, Wenger Corp,;
2. “Respond” Ceiling Diffuser Panels, Conwed,
3. “Inverted Pyramid Acoustical Panels”, #4848P, Associated Fiberglass Engineers;
4. “Pyramidal Shaped Diffuser #P44, Acoustical Resources;
5. “Golden Pyramid” by RPG Diffusor Systems.

D. Acoustical Sealant: Manufacturer’s standard non-drying, non-hardening, non-skinning, non-staining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission. SCAQMD rule 1168 compliant.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE OF MATERIALS

A. Materials shall be delivered to the job site in original, unopened containers and stored in a protected, dry area. Materials shall not be stored directly on concrete floors.

3.02 EXAMINATION

A. Verify that conditions are satisfactory for the installation of the acoustical ceiling system. If unsatisfactory conditions exist, notify the Architect, and do not start the installation until such conditions have been corrected.

B. Installation of ceiling panels shall not be started until windows and doors are installed and glazed and the HVAC system is in operation. All interior wet and dust-producing work shall be completed and dry.

3.03 INSTALLATION

A. Ceiling shall be installed according to manufacturer’s directions. Ceiling shall be level and tile and suspension systems square to walls.

B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

C. Items attached to or installed in ceiling panels shall be centered in panels.

D. Main “T” shall run parallel with the long dimension of the space. Exposed grids of suspension system shall have main beams and cross “T’s” suspended from the structure above by means of #12 gauge wires located 4’ o.c. parallel to main beams with main beams 4’ o.c. parallel to each other.

E. Provide supplemental steel framing/support as necessary to keep hanger wires vertical. Install supplemental hanger wires to independently support lighting, electrical, mechanical, HVAC, grilles, registers and other ceiling-mounted items.

F. At ceiling perimeters and columns penetrating the ceiling, secure angle molding on vertical surfaces to support “T’s” and ceiling boards; “T’s” shall rest on flanges of angles. Install acoustical ceiling boards in grids so that boards fit snugly in “T’s” and on flanges and are cut to fit on top of all electrical fixtures, diffusers, and similar flanges.

G. Installation shall be by skilled workmen following printed installation directions.

H. Particular attention should be given to correct location and alignment of hangers and supports. Hangers shall be spaced not more than 4’-0” o.c.e.w.

END OF SECTION 09 51 00

SECTION 09 54 23 LINEAR METAL CEILINGS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Perforated and non-perforated metal ceiling panels
2. Acoustical backing
3. Suspension systems
4. Accessories; provide other necessary items including devices for attachment overhead construction, secondary members, splines, splices, connecting clips, wall connectors, wall angles, and other devices required for a complete installation.
5. Supplemental support framing: Provide fully engineered secondary framing as required to meet code, conforming to layout shown in drawings, to support direct-hung metal ceilings suspension system.

B. This Section covers the general requirements only for Acoustical Metal Ceilings as shown on the drawings. The supplying and installation of additional accessory features and other items not specifically mentioned herein, but which are necessary to make a complete installation, shall also be included or clarified accordingly.

C. Qualification Data**:**

1. Test Reports: Certified reports from independent agency substantiating structural compliance to windloads and other governing requirements.
2. Certificates:
    a. Data substantiating manufacturer and installer qualifications.
    b. Certified data attesting fire rated materials comply with specifications.
3. Manufacturer's Instructions: Detailed installation instructions and maintenance data.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. E 84 – "Standard Test Method for Surface Burning Characteristics of Building Materials"
2. E 488 – "Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements"
3. B 209 – "Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate"
4. C 423 – "Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method"

5. E 580 – "Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint"
6. C 635 – "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings"
7. C 636 – "Recommended Practice for Installation of Metal Ceiling Suspensions Systems for Acoustical and Lay-in Panels"
8. A 641 – "Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire"
9. A 653 – "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip process"
10. E 1264 – "Classification for Acoustical Ceiling Products"
11. E 1477 – "Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by use of Integrating-Sphere Reflectometers"
12. D 1044 – "Practice for Abrasion Resistance"
13. D 1002 – "Practice for Adhesion Resistance"

1.4 SUBMITTALS

A. Product Data: Manufacturer's published literature, including specifications.

B. Product Certification: Manufacturer's certifications that products comply with specified requirements and governing codes including product data, laboratory test reports and research reports showing compliance with specified standards.

C. Shop Drawings: Submit shop drawings for reflected ceiling plans (RCP's), drawn to scale, and indicating penetrations and ceiling mounted items. Show the following details:

1. Reflected Ceiling Plan(s): Indicating metal ceiling layout, ceiling mounted items and penetrations.
2. Suspension System, Carrier and Component Layout.
3. Details of system assembly and connections to building components.

D. Samples for Verification: Full-size units (or as specified below) of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics. Submit samples for each type specified.

1. 11" square metal panel units.
2. 11" long samples of each exposed molding or trim.
3. 11" long samples of each suspension component.

1.5 QUALITY ASSURANCE

A. Manufacturer/Installer Qualifications:

1. Provide metal ceiling system components produced by a single manufacturer with a minimum 5 years' experience in actual production of specified products and with resources to provide consistent quality in appearance and physical properties, without delaying the work.

2. Provide suspension system components produced by a single manufacturer to provide compatible components for a complete metal ceiling system installation.

3. Perform installations using a firm with installers having no less than 3 years of successful experience on projects of similar size and requirements.

B. Regulatory Requirements:

1. Fire Rating Performance Characteristics: Install system to provide a flame spread of 0 - 25, complying with certified testing to ASTM E 84.

2. Structural Criteria: Install and certify system to comply with structural and wind load requirements of governing codes.

3. Installation Standard for Suspension System: Comply with ASTM C 636.

C. Mock-Up: Prior to beginning installation erect a mock-up section, where directed, using all system components.

D. Pre-installation Conference: Conduct a conference, prior to start of installation, to review system requirements, shop drawings, and all coordination needs.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver system components in manufacturer's original unopened packages, clearly labeled.

B. Store components in fully enclosed dry space. Carefully place on skids, to prevent damage from moisture and other construction activities.

C. Handle components to prevent damage to surfaces and edges, and to prevent distortion and other physical damage.

1.7 PROJECT CONDITIONS

A. Begin system installations only after spaces are enclosed and weather-tight, and after all wet work and overhead work have been completed.

B. Prior to starting installations, allow materials to reach ambient room temperature and humidity intended to be maintained for occupancy.

1.8 WARRANTY

A. Provide specified manufacturer's warranty against defects in workmanship, discoloration, or other defect considered undesirable by the Architect or Employer.

B. This warranty shall remain in effect for a minimum period of one (1) year from date of initial acceptance.

1.9 MAINTENANCE & EXTRA MATERIALS

A. Maintenance Instructions: Provide manufacturer's standard maintenance and cleaning instructions for finishes provided.

B. Extra Materials: Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Only typical system components are included with attic stock.

1. Acoustical Metal Ceiling Pan Units: Full-size units equal to two percent (2%) of amount installed.

2. Ceiling Suspension System Components: Quantity of each grid and exposed component equal to two percent (2%) of amount installed.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Basis of Design - Box linear metal panel ceiling system by CertainTeed Architectural; www.CertainTeed.com/Architectural

B. Substitutions: Refer to section 01 25 13

2.2 SYSTEM MATERIALS

A. Linear metal panel ceiling system for interior and exterior installations:

B. Panel Profile Type: Box 6, roll formed; 025" interior/exterior thick aluminum with square edges; 5-5/32" wide, 5/8" deep with 27/32" reveal to form a 6" module.

1. Panel length: Standard 12'-0”

2. Closure: Flat Recessed Closure: 5/8" wide roll-formed aluminum hat-shaped closure panel to snap-fit between ceiling panels.
Recessed Closure required for exterior applications.

a. Finish: Refer to Material Schedule on drawing sheet A9.00

C. Linear Suspension System:

1. Carrier: Universal hat-shaped, .038" roll-formed aluminum section with hook-shaped tabs spaced to receive ceiling panels at 2" on-center and 27/32" apart. Support holes spaced 4" on-center. Finish: Factory-applied black enamel.

2. Hanger Wire: 12 gage galvanized carbon steel hanger wire.

3. Seismic/Wind Uplift Compression Struts: 1-1/2" (38 mm) deep, 16 Ga., cold-rolled steel "C" channels.

D. Perforations Refer to drawings for areas to receive perforated product

E. Panel Finish:

1. Paint; color to be selected by architect

a. Decorated Wood-Look Powder Coat

2.3 ACCESSORY MATERIALS

A. Panel End Caps: Formed, stamped, or milled end caps with matching finish

B. Panel Splice: Formed aluminum insert designed to snap-fit between ends of two ceiling panels. Finish: to match panel

C. Access Door: 2' x 2' aluminum access frame with hinges and retainer clip for downward-acting access panel to plenum space.

D. Acoustic Material – interior only: Non-woven black fabric with 1" thick glass fiber, 1-1/2 pcf density, polywrapped

1. NRC Rating: .75

E. Air Distribution Devices: Provide distribution devices that are independently suspended, adjustable from below finished ceiling, capable of being concealed behind (invisible to view) and fully integrated with ceiling system to allow no interruption of ceiling components.

F. Lighting Fixtures (Modular Type "M" or "MT" flange) and HVAC diffusers: Optional.

PART 3- EXECUTION

3.1 EXAMINATION

A. Examine substrates and structural framing to which acoustical metal panels attach or abut, with installer present, for compliance with requirements specified in this and other Sections that affect installation and anchorage, and other conditions affecting performance of metal panel ceilings.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.

B. Measure each ceiling area and establish layout of acoustical metal pan units to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width units at borders, and comply with layout shown on reflected ceiling plans.

C. Survey substrate for wall attachment to assure squareness and proper elevation for wall panel installation.

3.3 INSTALLATION

A. General: Install acoustical metal pan ceilings, per manufacturers shop drawings provided, per manufacturer's written instructions and to comply with publications referenced below.

1. CISCA "Ceiling Systems Handbook"

2. Standard for Ceiling Suspension System Installations - ASTM C 636

3. Standard for Ceiling Suspension Systems Requiring Seismic Restraint - ASTM E 580

4. IBC (International Building Code) Standard for Seismic Zone for local area

B. Suspend ceiling hangers from building's approved structural substrates and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.

2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

3. Where width of ducts and other construction within ceiling plenum produce hanger spacings that interfere with location of hangers at spacing required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Utilize supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

4. Where used secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

5. Space hangers not more than 48" on-center, along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 12" from ends of each member. Supply supporting calculations from licensed Structural Engineer verifying hanger spacing meets all requirements, when spacing exceeds those recommended.

6. Level grid to 1/8" in 10' from specified elevation(s), square and true.

7. Adjust suspension system runners so they are square (within .5 degree from 90 degrees) and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

C. Secure bracing wires to ceiling suspension members and to supports acceptable to Architect/Engineer and/or inspector. Suspend bracing from building's structural members and/or structural deck, as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs (unless directed otherwise).

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical metal pan. Method of edge trim attachment and design of edge trims to be approved by Architect.

1. Screw attach moldings to substrate at intervals not more than 18" on-center and not more than 6" from ends, leveling with ceding suspension system to a tolerance of 1/8" in 10'. Miter corners accurately and connect securely.

2. Do not use exposed fasteners, including pop rivets, on moldings and trim without prior written approval, or unless detailed otherwise.

E. Scribe and cut acoustical metal panel units for accurate fit at penetrations by other work through ceilings. Stiffen edges of cut units as required to eliminate evidence of buckling or variations in flatness exceeding referenced standards for stretcher-leveled metal sheet.

F. Install acoustical metal panel units in coordination with suspension system. Fit adjoining units to form flush, tight joints. Scribe and cut units for accurate fit at borders and around construction penetrating ceiling.

3.4 ADJUST AND CLEAN

A. Adjust components to provide uniform tolerances.

B. Replace all ceiling panels that are scratched, dented or otherwise damaged.

C. Clean exposed surfaces with non-solvent, non-abrasive commercial type cleaner.

END OF SECTION

SECTION 09 64 55 RESILIENT WOOD FLOOR-STAINED SURFACE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work under this contract shall include the furnishing of all labor, materials, tools, equipment, transportation, services, etc., and supervision necessary to complete the installation of the resilient stage floor system. All work shall be furnished as described in these specifications and as illustrated on the accompanying Drawings. The work is comprised of, but not limited to, the following principal items:

1. Verification of dimensions and conditions of site,
2. Sheet vapor retarder on substrate surface,
3. Plywood subflooring and cushion sleepers,
4. Hardwood Flooring, nailed,
5. Surface finishing.

1.02 RELATED DOCUMENTS

A. The General Conditions, Supplementary General Conditions, bidding, and contract conditions shall apply to, and form a part of this Section.

B. Concrete

C. Rough Carpentry

1.03 RESPONSIBILITY

A. Provide working overall systems in accordance with good flooring practice and accepted industry standards. Verify the completeness of the parts list, type numbers and the overall suitability of the material to meet the intent of the design. Notify the Architect of any discrepancies, relevant to said information, prior to the bid date, for review.

B. Minor items of material needed in order to meet the requirements stated above, even if not specifically mentioned herein or on the drawings, shall be supplied without claim for additional payment.

1.04 JOB CONDITIONS

A. Verify all conditions applicable or pertaining to this work. Coordinate with scheduled work of any other trades and notify Architect in writing of discrepancies, conflicts, or omissions prior to bid time or correct same at Contractor's expense.

B. So far as possible, the drawings show arrangement of material which will fit into the spaces available. If conditions exist at the jobsite that make installation of work as shown impossible, prepare drawings for Architect 's review showing how the work may be installed. Also provide Architect with cost for contractor to provide additional work and outline work such that Owner may opt to perform said work. On acceptance of the conditions by the Architect, install the work as directed by the Architect.

C. Environmental requirements:

1. All flooring materials (including sleepers and plywood underlayment) must be handled, stored and installation scheduled such that equilibrium moisture content is maintained.
   a. Do not handle during excessively humid conditions.
   b. Protect from excessively humid conditions at all times.
   c. Do not deliver materials to project site or install materials unless storage and installation areas, that are clean, ventilated, enclosed and weather tight, can be provided and continuously maintained to the temperature and humidity conditions of Owner-occupied use.
      1) Concrete and other cementitious material work must be complete, fully cured and dry.
      2) Wood framing, gypsum board (drywall), painting and similar moisture-producing construction activities must be complete and dry.

2. Notify Architect of any excessive moisture sources or other similar conditions that are not conducive for a high quality flooring installation acceptable to Architect and correct as necessary before installation.

D. After completion of wood flooring installation, maintain temperature and humidity conditions until acceptance by Owner.

E. Contractor shall take care not to damage any materials or equipment that will be reused or to disconnect any wiring other than as required to install new materials or equipment. Any material, which will be reused, that is damaged by the Contractor, shall be repaired or replaced by the Contractor at no cost to the Owner.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Floor manufacturer shall be a firm established in the industry that has been in business for a minimum of ten years. Manufacturer shall submit a list of projects where the specified flooring has been installed.

B. Installer Qualifications: Installer shall have a minimum of five continuous years experience and shall be approved by the manufacturer of the flooring materials.

C. Single Installer Responsibility: Entire resilient wood floor system shall be installed by a single firm (herein referred to as the Contractor), for undivided responsibility. Include anchorage system, sleepers, sub-flooring, adhesives or mastics, resilient mounts, flooring, insulation, trim, expansion provisions, and other accessory items as indicated.

D. Obtain all hardwood flooring from single manufacture or source to ensure match of quality, color, pattern, and texture.

E. Obtain finish from single source, single lot, to ensure color match.

1.06 SUBMITTALS

A. Shop Drawings:

1. Indicate floor joint pattern, grain direction, and termination details.
2. Show cuts at edges, entrances, alcoves, change of flooring, and other obstructions or changes.

3. Indicate provisions for expansion and contraction.
4. Indicate installation details for hardwood facing.

B. Product Data: Provide data for floor materials and floor finishing system.

C. Samples:

1. Wood flooring in each grade, species, and appearance.
2. Submit one 24" x 24" sample illustrating floor finish, color and sheen.

D. Submit certification that products meet or exceed specified requirements.

E. Manufacturers Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

1.07 DELIVERY, STORAGE AND HANDLING

A. Protect wood flooring from excessive moisture in shipment, storage and handling. Deliver in unopened bundles and store in a dry place, with adequate air circulation.

1.08 WARRANTY

A. Contractor shall provide Owner with copies of 3- year warranty for finished wood flooring and associated work, agreeing to repair or replace flooring which shrinks, wraps, cracks, or otherwise deteriorates, or which breaks it anchorage or bond with substrate or otherwise fails to perform as required or as represented by manufacturer, due to failures of materials and workmanship. Warranty shall be signed by Contractor, who shall assume responsibility for obtaining warranties on materials from manufacturer.

1.09 MAINTENANCE DATA

A. Maintenance Data: Submit maintenance manuals of maintenance procedures, recommended maintenance materials, a suggested schedule for cleaning, stripping and re-finishing, stain removal methods, and polishes and waxes.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall be new and of first quality. All materials and equipment shall be manufactured and installed in accordance with applicable standards of the American Lumber Standards Committee (ALSC), the American Plywood Association (APA), the Surface Burning Characteristics of Building Materials (ASTM E84), the American Wood Preservers Association (AWPA) - All Timber Products - Preservative Treatment by Pressure Process, the Southern Pine Inspection Bureau (SPIB), the West Coast Lumber Inspection Bureau (WCLIB), the Western Wood Products Association (WWPA), and DIN test 18032-Part II, Otto-Graf Institut, Stuttgart, West Germany plus any and all local government or other applicable codes.

B. The flooring products of certain manufacturers are specified by catalog number for establishing a standard of quality. Items equal in quality and performance by manufacturers other than those specified will be permissible upon acceptance by the Owner.

2.02 MATERIALS

A. Flooring: Species and grade stamped on underside of each piece, conforming to the following:

1. Species: Maple
2. Grade: 2nd and better
3. Cut: Plain sawn
4. Kiln dried
5. Actual Thickness: 25/32 inch
6. Nominal Width: 2 ¼”
7. Edge: Tongue and Groove
8. End: End Matched
9. Length: Random, minimum 15 inches to 8 foot lengths.
10. Profile: Cross profile for added flexibility and resilience (conforms to DIN 18032, Part II)

B. Plywood Subflooring: 2 layers ½” (Total 1" thick) x 4' x 8' CD-Exterior Grade, Fir or Southern Pine.

C. Sleepers: 1-3/8" x 2-5/8" x 8' treated wooden sleeper.

D. Hardwood Facing: Species and grade stamped on underside of each piece, conforming to the following:

1. Species: Maple
2. Grade: 2ND and better
3. Cut: kerfed traditional
4. Kiln Dried
5. Actual Thickness: 25/32 inch
6. Actual Width: As required equal to depth of slab plus depth of new floor.
7. Length: Random, minimum 6 foot to 16 foot lengths

2.03 ACCESSORIES

A. Vapor Retarder: Polyethylene sheeting, 6 mil thick; 2 inch wide self-adhesive, reinforced tape for joint sealing.

B. Nails: Hardened steel barbed type for use with a power driver at finish flooring. One inch coated staples for use with a power driver at subfloor.

C. Channel anchors: 1-1/4" pneumatic or powder actuated concrete anchor.

D. Cork Expansion Strip: Composition cork expansion strip; FS HH-C 576, Type I-B, Class 2.

E. Loose Granular Perlite Insulation: ASTM C549, Type II and III, treated with silicone for water repellency.

F. Perimeter Base molding – vent cove base anchored to walls with base cement of screws and anchors. Use premolded outside corner and neatly mitered inside corner.

2.04 FINISHES

A. Stain: Flat stain latex compatible with floor system. Reference 09 90 00 Painting and Coating

B. Seal: Penetrating, water-based polyurethane seal. Reference 09 90 00 Painting and Coating.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that substrate surface is smooth and flat to plus or minus 1/8" over 10 feet.

3.02 PREPARATION

A. Broom clean substrate surfaces.

B. Condition flooring. Allow a minimum of 7 days for acclimatization to final installation areas. All materials must be permitted to achieve a stabilized (equilibrium) moisture content that will approximate conditions of occupied use. All flooring bundles and sealed packages shall be broken and loosely piled to acclimate the flooring to environmental conditions.

3.03 INSTALLATION - FLOORING

A. Comply with flooring manufacturer's instructions and recommendations for applications indicated.

B. Cover entire area with vapor barrior, lap edges and ends six inches, and tape seal in place.

C. Place sleepers 16" O.C. end-to-end, staggering end joints in adjacent rows. Anchor at predetermined locations (approximately 22" O.C.).

D. Install 1" plywood subfloor parallel to sleeper channels and securely fasten subfloor 6" O.C. along each channel sleeper. Leave gap for expansion at end of floor.

E. Machine fasten hardwood flooring 10-12" O.C. perpendicular to top subfloor layer with end joints properly driven up and provide proper spacing for humidity conditions as recommended by manufacturer. Provide 2" expansion void at perimeter and at all vertical obstructions except along front edge of stage.

F. Perimeter Base Molding- Install vent cove base anchored to walls with base cement or screws and anchors. Use pre-molded outside corners and neatly mitered inside corner.

G. Level the installed flooring to uniform flatness of +/- 1/8 inch over 10 feet.

3.04 FINISHING

A. Sand flooring to smooth, even finish with no evidence of sander marks. Take precautions to contain dust. Remove dust by vacuum.

B. Sand flooring with drum sander, edger, buffer and hand scrapper.

1. Use coarse, medium and fine grade sandpaper.
2. After sanding with drum sander, buff entire floor using 100 grit screenback or equal grit sandpaper, with a heavy-duty buffing machine.
3. Vacuum or tack floor before first coat of finish.

C. Level the finished floor to +/- 1/8 inch over 10 feet.

D. Finish:

1. Mask off adjacent surfaces and seating area.
2. Apply finish per manufacturer's recommendations, allowing sufficient dry time before applying finish coat.
3. Apply two applications of penetrating finish per manufacturer's recommendations. Do not apply plastic coating of any type. Final finish shall be low luster.

3.05 EXTRA STOCK/REPLACEMENT MATERIAL

A. After completion of work, deliver to project site not less than 5% of the quantity of flooring materials (sleepers, sub-floor and floor surface) of type installed on the project, in specified sizes.

B. Provide three (3) one-gallon containers of specified floor finish.

3.06 TESTS AND INSPECTIONS

A. Test concrete slab for excessive moisture at multiple locations as directed by Architect.

B. When requested by Architect, manufacturer must obtain Re-inspection Service to inspect wood flooring product quality and completed flooring installation. Written reports by inspectors must be submitted directly to Construction Manager.

C. Other tests as required by Architect

3.07 PROTECTION

A. Protect completed flooring during remainder of construction period with heavy Kraft paper or other suitable covering, so that flooring and finish will be without damage or deterioration at time of acceptance.

3.08 CLEANING

A. Clean work areas of trash and debris.

B. Clean floor surfaces in accordance with manufacturer's instructions.

END OF SECTION 09 64 55

SECTION 09 65 00 RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Vinyl Composition Tile flooring with accessories
2. Transition strips between flooring types
3. Rubber Stair Treads and Risers (where applicable)

1.2 NOT USED

1.3 REFERENCES

A. ASTM E 648; Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source (Flooring Radiant Panel Test).

B. ASTM E 662: Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

C. ASTM F 970: Standard Test Method for Static Load Limit

D. ASTM F 710; Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring.

E. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

F. ASTM F 1066: Specification for Vinyl Composition Floor Tile.

1.4 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of material to be provided for Project.

B. Samples: Furnish actual sample of each type of tile, edge strip, and stair tread required for Project. For manufacturers other than basis of specification, submit entire color catalog (chips) for Architect’s selection. Color charts are NOT ACCEPTABLE for color selection.

C. Certification: Furnish manufacturer's certification based on independent testing laboratories indicating compliance with specified requirements.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Firm with minimum five years successful experience completing resilient tile installation similar to that required.

B. Pre-installation Conference: Conduct meeting at site prior to commencing work related to resilient tile installation.
1. Require attendance of parties directly affecting resilient tile installation.
2. Review site conditions, procedures, and coordination required with related work.

C. Field Mock Up: Provide mock-up of each type of installation using approved materials and

specified methods of installation. Obtain Architect's acceptance of mock up prior to start of resilient tile installation.

1.6 SITE CONDITIONS

A. Maintain minimum 65 degree F air temperature at flooring installation area for minimum two days prior to, during, and for minimum 24 hours after installation of resilient tile.

B. Store flooring materials in area of application; allow two days for material to reach same temperature as area and maintain for minimum 24 hours after completion of installation.

1.7 ATTIC STOCK

A. Provide the following quantities of extra materials and deliver to Owner for storage and future use:
   1. VCT: 2 unopened cartons of each color used.
   2. Rubber Treads and Risers: 1 unopened carton of color used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Manufacturers listed, whose product meets or exceeds the specifications are approved for use on the Project with Architect’s approval and equivalency of color selections below. Alternate manufacturers must have equivalent colors to those scheduled below. Inadequate color selection shall be cause for rejection. Other manufacturers must have a minimum of five (5) years’ experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.
   1. a. Approved Vinyl Composition Tile Manufacturers (12”x12”)
      1) Azrock Collection by Johnsonite / Tarkett Commercial
      2) Armstrong Excelon (Basis of Specification for color selection)

2.2 VINYL COMPOSITION TILE

A. Size: 12-inch by 12-inch

B. Gauge: 1/8 inch

C. Flammability: Provide materials with Class 1>0.45 CRF (critical radiant flux) or higher when tested in accordance with ASTM E 648, Flooring Radiant Panel Test.

D. Smoke Density: Provide materials with smoke density of less than 450 when tested in accordance with ASTM E 662.

E. Static Load: Provide materials with static load limit of 150 psi or higher.

F. Slip Resistance: Provide materials with minimum rating for floors of > 0.60.

G. Color and Pattern:
   1. Colors as selected by Architect from manufacturers range of available standard colors to match existing flooring tiles.

2.3 RESILIENT FLOORING ADHESIVE

A. Ultra high moisture resistant adhesives equivalent to Mapei Ultrabond ECO 711, or equal moisture resistant formulation products from flooring manufacturer approved adhesive manufacturers. Products with moisture vapor emission rates **less than** 8lbs. per 1,000 square feet per 24 hours are not acceptable.

2.4 RUBBER TREADS AND RISERS

A. Type: Integral one-piece tread and riser with raised truncated dome texture.
   1. Length: Provide longest length pieces available to reduce amount of seams.
   2. Color: To be selected by Architect from manufacturer's full range of colors.
   3. Substrate adhesives pursuant to manufacturer's recommendations.

B. Basis of specification: Roppe Stair Tread #96 Vantage One-Piece Tread and Riser Design Tread.

2.5 ACCESSORIES

A. Joining and Edge Finish Moldings:
   1. Usage: For use at flooring terminations with other flooring.
   2. Basis of Specification: Schluter Systems.
      a. Type: Tapered or bullnose edge, as required to provide juncture at edge of adjacent floor surfaces where transitions are indicated on drawings for the following condition.
         i. Resilient Tile (VCT) to Concrete: Schluter RENO-U
      b. Where applicable, all transitions shall occur at the centerline of closed door.
      c. Transitions at top of stairs shall be of same manufacturer as transition strip edge finish moldings and shall be mechanically bonded to floor system. Architect to select product from manufacturer line submitted.
      d. Material: Rubber or vinyl as recommended by flooring manufacturer to suit application.
      e. Primers and Adhesives: Water and alkali resistant, zero regulated VOC types as recommended by flooring manufacturer for specific application.
         1. For increased substrate moisture and alkali tolerance, IQ Spray Smart adhesive system (Gold: Max 7 lbs (MVER) & 11 pH Tolerance or Platinum: Max 10 lbs (MVER) & 12 pH Tolerance) may be used only if approved or recommendation by flooring manufacturer.
      f. Color: To be selected by Architect from manufacturer's full range of colors.
   3. Basis of Specification: Schluter Systems
      a. Type: As required to provide juncture at edge of adjacent floor surfaces where transitions are indicated on drawings for the following condition.
         i. Resilient Tile (VCT) to Quarry Tile (QT) and Ceramic Tile (CT): Refer to Floor Finish Drawings.
      b. Where applicable, all transitions shall occur at the centerline of closed door.
      c. Material: Aluminum
      d. Color: Satin anodized, unless noted otherwise

B. Subfloor Filler: Hydraulic/Portland cement based material designed for providing thin solid surface for leveling and for minor ramping of subsurface to adjacent floor finishes. Use material capable of being applied and feathered out to adjacent floor without spoiling.

C. Floor Finish: Finish as recommended by flooring manufacturer for material type and location.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions of substrate are suitable for installation of resilient tile in accordance with manufacturer recommendations.
   1. Concrete to comply with ASTM F 710, to be free of materials which could interfere with adhesion of resilient flooring, to be tested using the quantitative calcium chloride test as detailed under ASTM F 1869 with results of 5 lbs. or less of vapor transmission (MVER), surface alkali of 9 or less as measured by pH test paper, and free of carbonization and dust. (Adjust moisture & alkali limits, as detailed under IQ Spray Smart system if selected)
   2. Wood underlayment to have a smooth fully sanded face, free of irregularities, and to be free of substances, which could interfere with adhesion of resilient tile.

3.2 PREPARATION

A. Comply with manufacturer recommendations for preparation of substrate.
   1. Concrete, Terrazzo, Latex Patching Compound Floors: Comply with ASTM F 710 in addition to manufacturer recommendations for preparation of substrate.

B. Remove subfloor ridges and bumps; fill low spots, cracks, joints, holes, and defects with subfloor filler.

C. Clean floor and apply, trowel, and float filler to leave smooth, flat hard surface.

D. Prohibit traffic in area until filler is cured.

3.3 TILE INSTALLATION

A. If applicable, patterns consisting of complex shapes requiring cutting and inlay shall be achieved by means of water-jet or other precision cutting method. Field cutting regular or less complex shapes shall be at the Contractor’s option. Attempting to field cut complex shapes shall be at the Contractor’s risk and may be means for rejection if the workmanship is not acceptable as determined by the Owner and/or Architect.

B. Compliance: Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

C. Orientation of Tile Grid: As indicated on Drawings.

D. Alignment of Tile: Grain reversed in adjacent tiles using color pattern as indicated on Drawings.

E. Comply with manufacturer's recommendations and installation instructions.

F. Open floor tile cartons, enough to cover each area, and mix tile to ensure shade variations do not occur within any one area.

G. Clean substrate.

H. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.

I. Set flooring in place; press with heavy roller to ensure full adhesion.

J. Install minimum 1/2 tile at room and area perimeter.

K. Terminate resilient flooring at centerline of door openings where adjacent floor finish is dissimilar.

L. Install edge strips at unprotected and exposed edges where flooring terminates.

M. Fit flooring to walls, columns, floor outlets and other appurtenances, to produce neat joints.

3.4 RUBBER TREAD INSTALLATION

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

B. Comply with manufacturer's recommendations and installation instructions.

C. Clean substrate.

D. Spread cement evenly in quantity recommended by manufacturer to ensure adhesion over entire area of installation; spread only enough adhesive to permit installation of flooring before initial set.

E. Set treads in place; press with heavy roller to ensure full adhesion.

F. Fit flooring to walls, columns, floor outlets and other appurtenances, to produce neat joints.

3.5. CLEANING AND POLISHING

A. Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

B. Remove excess adhesive from floor, base, and wall surfaces without causing damage to surfaces due to cleaning operations, and repair damage to adjacent materials caused by resilient tile installation using methods recommended by adjacent material manufacturers.

C. Clean floors taking care not to wash floors prior to adhesive set.

D. Final floor finishing/waxing to be performed by Owner. Contractor to coordinate with Owner final finishing with construction schedule.

3.7 PROTECTION

A. Prohibit traffic from floor for 48 hours after installation.

B. Protect floors from damage during remainder of construction operations; do not move heavy objects over resilient tile flooring, which could damage flooring.

C. Replace all flooring damaged by subsequent construction operations.

END OF SECTION 09 65 00

SECTION 09 65 13 RESILIENT BASE

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes:

1. 4” Rubber Base.

1.02 REFERENCES

A. ASTM E 648; Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source (Flooring Radiant Panel Test).

B. ASTM E 662: Test Method for Specific Optical Density of Smoke Generated by Solid Materials.

C. ASTM F 970: Standard Test Method for Static Load Limit

D. ASTM F 1869: Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.03 PERFORMANCE REQUIREMENTS

A. Meets or exceeds the performance requirements for resistance to heat/light aging, chemicals, and dimensional stability when tested to the methods, as described, in ASTM F-1861.

B. Flexibility: ASTM F 137 - Will not crack, break, or show any signs of fatigue when bent around a 1/4" (6.4 mm) diameter cylinder.

C. Resistance to Light: ASTM F 1515 – Passes $\Delta E \leq 8.0$

D. Chemical Resistance: ASTM F 925 Passed – Acetic Acid 5%, Isopropyl Alcohol 70%, Sodium Hydroxide 5%, Hydrochloric Acid 5%, Ammonia 5%, Phenol 5%, and Acid Sulfuric 5%.

E. Chemical Resistance (ASTM F 925): Passed - 5% Acetic acid, 70% Isopropyl alcohol, Sodium hydroxide solution (5% NaOH), Hydrochloric acid solution (5% HCl), Sulfuric acid solution (5% H2SO4), Household ammonia solution (5% NH4OH), Household bleach (5.25% NaOCl), Disinfectant cleaner (5% active phenol)

F. Fire Resistance:

1. ASTM E 84/NFPA 255 (Flame/Smoke) – Class B, < 450
2. ASTM E 648 (NFPA 253): Critical Radiant Flux – Class 1

1.04 SUBMITTALS

A. Product Data: Furnish manufacturer's literature for each type of material to be provided for Project.

B. Samples: Furnish actual sample of each type of base, edge strip, transition strip required for Project. Color charts are NOT ACCEPTABLE for color selection.

C. Certification: Furnish manufacturer's certification based on independent testing laboratories indicating compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Firm with minimum five years successful experience completing resilient tile installation similar to that required.

B. Pre-installation Conference: Conduct meeting at site prior to commencing work related to resilient base installation.

1. Require attendance of parties directly affecting resilient tile installation.

2. Review site conditions, procedures, and coordination required with related work.

C. Field Mock Up: Provide mock-up of each type of installation using approved materials and specified methods of installation. Obtain Architect's acceptance of mock up prior to start of resilient tile installation.

1.06 SITE CONDITIONS

A. Maintain minimum 65 degree F air temperature at flooring installation area for minimum two days prior to, during, and for minimum 24 hours after installation of resilient tile.

B. Store flooring materials in area of application; allow two days for material to reach same temperature as area. and maintain for minimum 24 hours after completion of installation.

1.07 ATTIC STOCK

A. Provide the following quantities of extra materials and deliver to Owner for storage and future use:

1. Rubber Base: 100 ft. of each type/color used

PART 2 - PRODUCTS

2.01 MATERIALS

A. Approved Rubber Base Manufacturers:
Basis of Design style & color, refer to drawings Material Legend.

1. Roppe Corporation
2. Burke Base TS
3. Johnsonite Corp.
4. Flexco
5. Endura Rubber Flooring by Burke
6. Mannington Commercial

2.05 RUBBER BASE

A. TYPE TS - 1/8" thick thermoset vulcanized SBR rubber in accordance with ASTM F-1861.

B. Description: resilient rubber; satin finish.

1. Cove Profile height: 4 inches.

2. Length: 120 feet coil lengths.
3. Color: Selection from manufacturer's standard array.
4. Substrate adhesives pursuant to manufacturer's recommendations for porous or non-porous surface. Use manufacturer's recommended brush or roller applied contact adhesive for non-porous surfaces
5. Spread rate: 225 l.f. /gallon or as recommended by manufacturer

2.06 ACCESSORIES

A. Edge Strips (Moldings): Homogeneous vinyl, tapered or bullnose edge. Color: As selected by Architect to compliment vinyl composition tile.

B. Subfloor Filler: Hydraulic/Portland cement based material designed for providing thin solid surface for leveling and for minor ramping of subsurface to adjacent floor finishes. Use material capable of being applied and feathered out to adjacent floor without spoiling.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify conditions of substrate are suitable for installation of base in accordance with manufacturer recommendations.

1. Concrete to comply with ASTM F 710, to be free of materials which could interfere with adhesion of resilient flooring, to be tested using the quantitative calcium chloride test as detailed under ASTM F 1869 with results of 5 lbs. or less of vapor transmission (MVER), surface alkali of 9 or less as measured by pH test paper, and free of carbonization and dust. (Adjust moisture & alkali limits, as detailed under IQ Spray Smart system if selected)

2. Wood underlayment to have a smooth fully sanded face, free of irregularities, and to be free of substances, which could interfere with adhesion of resilient tile.

3.02 PREPARATION

A. Comply with manufacturer recommendations for preparation of substrate.

B. Wall Base and adhesives must be site conditioned at room temperature for a minimum of 48 hours prior to, during, and after installation. Room temperature must be maintained between 65 degrees and 85 degrees F with HVAC system operating.

C. A minimum temperature of 55 degrees F must be maintained afterwards.

D. The ambient relative humidity should be between 40% and 60%.

E. All walls must be clean, smooth, flat and dry. The surface must be free of all dust, loose particles, solvents, paint, grease, oil, wax, alkali, sealing/curing compounds, old adhesive, and any other foreign material, which could affect installation. Remove existing adhesive mechanically – do not use chemical adhesive removers or solvents. Fill all depressions, cracks, and other surface irregularities with a good quality patching compound.

3.04 WALL BASE INSTALLATION

A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch wall base during installation.

E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.

F. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.

2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.

3.05 CLEANING AND POLISHING

A. Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

A. Remove excess adhesive from base, and wall surfaces without causing damage to surfaces due to cleaning operations, and repair damage to adjacent materials caused by installation using methods recommended by adjacent material manufacturers.

B. Clean floors taking care not to wash floors prior to adhesive set.

3.05 PROTECTION

A. Prohibit traffic from floor for 48 hours after installation.

B. Protect floors from damage during remainder of construction operations; do not move heavy objects over resilient tile flooring, which could damage flooring.

C. Replace all flooring damaged by subsequent construction operations.

END OF SECTION 09 65 13

SECTION 09 65 25 VINYL TILE/PLANK FLOORING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Luxury Vinyl Tile (LVT) flooring with dimensional printing technology consisting of monolithic through color tile, surface decorated tile or printed film vinyl tile with smooth or embossed surface, adhesive attached with accessories in locations shown on drawings.

1.2 REFERENCES

A. ASTM International (ASTM)

1. F2710, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
2. F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

1.4 WARRANTY

A. Warranty - 20-Year Limited Non-Prorated Commercial Material Warranty. Coverage includes:

1. 100% Cost of Material for the entire duration of Warranty (20 Years)
2. Pro-Rated Cost of Labor (Fair-Market Value) for the first 10 Years
3. One-Time Transferability of Warranty

1.5 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Manufacturer's installation instructions.
3. Manufacturer’s warranty and maintenance / cleaning instructions

B. Samples:

1. Actual samples or color charts showing manufacturer's full range of colors for Architect's selection.

2. 3-7 inch width by 48 inch plank and/or 18 inch by 18 inch tile in each color selected for approval.

C. Certification: Manufacturer's affidavits that materials used in the Project contain no asbestos.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Physical Properties

a. Construction: Solid Plank and/or Tile made from 100% Virgin Vinyl
b. Wear Layer Thickness: min 30 mil (0.7mm)
c. Total Thickness (Gauge): min 0.125" (3.2mm)
d. Finish: Urethane Coating with Ceramic Bead Particles or Aluminum Oxide

2.2 ACCEPTABLE MANUFACTURERS

A. Basis of Design: Refer to drawings - Room Finish Schedule 'Material Schedule"

B. Substitutions: Architect approved equal submitted in accordance with provisions of Section 01 25 13 – Product Substitution Procedures. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.3 MATERIALS - ALL MATERIALS MUST BE ASBESTOS FREE

A. Luxury Vinyl Tile/Plank (LVT):
1. Refer to Legend-Room Finish Schedule, drawing sheet A9.0 for Product names, Patterns, Sizes and Colors.

B. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

C. Cement-based Floor Leveling Material: ARDEX K-15 Self-Leveling Underlayment Concrete manufactured by Ardex Engineered Cements, Aliquippa, PA; (724) 203-5000; or CX Self-Leveling Underlayment manufactured by BASF Chemrex Inc.; Koster SL Self Leveling Underlayment, Virginia Beach, VA 757-425-1206; or equal. Gypsum-based products are prohibited. Level flush with adjacent floor finish.

D. Joining and Edge Finish Moldings:
1. Usage: For use at flooring terminations with other flooring.
   a. Type: Tapered or bullnose edge, as required to provide juncture at edge of adjacent floor surfaces.
   b. Size: One (1) inch wide by 1/8 inch thick or as applicable to the type of flooring and condition.
   c. Material: Brushed Aluminum or Stainless Steel metal transition edge.
   d. Color(s): As selected by Architect from manufacturer's available colors.
   e. Approved Manufacturers: Schluter, or Architect approved equal.

E. Stair Nosing: Provide Loxcreen LV8703 Stair Nosing for Luxury Vinyl tile; Satin Titanium.

F. Adhesive and adhesive encapsulators:
1. Refer to Manufacturer's Installation Guide/Manual for the recommended Adhesive(s) and/or Adhesive Encapsulator(s) to use for installation.

G. Finishes & Cleaners
1. Refer to Manufacturer's Installation and/or Maintenance Guides/Manuals for recommended Finishes & Cleaners, including (but not limited to):
   a. Matte Finish
   b. Gloss Finish
   c. Vinyl Stripper (For removal of non-factory applied Finishes)
   d. No-Rinse Cleaner
   e. Scratch Remover
   f. Black Scuff & Adhesive Remover

H. Other Materials: Provide other materials, not specifically described but required for a complete and proper installation.

2.4 EXTRA STOCK

A. Deliver to the Owner:
1. Four (4) percent or one (1) unopened carton of each color and pattern of tile selected, whichever is greater.
2. One (1) gallon container of each type adhesive used for flooring.

PART 3 - EXECUTION

3.1 EXAMINATION AND SURFACE CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

1. Verify that field measurements, product, adhesives, substrates, surfaces, structural support, tolerances, levelness, temperature, humidity, moisture content level, pH, cleanliness and other conditions are as required by the manufacturer, and ready to receive Work.

B. Verify that substrate is contaminant-free (including old adhesives and abatement chemicals).

C. Test substrates as required by manufacturer to verify proper conditions exist.

1. Concrete:
a. Check for concrete additives such as fly ash, curing compounds, hardeners, or other surface treatments that may prevent proper bonding of floor coverings.
b. Moisture testing: Perform either the In-Situ Relative Humidity (RH) test (ASTM F2170) or Moisture Vapor Emission Rate (MVER) test (ASTM F1869). NOTE: Refer to the Manufacturer's Installation Guide/Manual for the maximum allowable substrate moisture content. Substrates above the maximum allowable moisture content will require a moisture mitigation system.
c. Perform alkalinity testing to verify pH level is between 7 to 10 per ASTM F710.
d. Check substrate for absorbency per manufacturer's recommendations.
e. Perform bond testing per ASTM F710 to determine compatibility of adhesive to concrete substrate.

D. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Prepare concrete floors to receive flooring in accordance with ASTM F710

B. Verify substrates are smooth, level, at required finish elevation, and without more than 1/8 inch in 10 feet-0 inch variation from level or slopes shown on the drawings.

C. Broom clean or vacuum the surfaces to be covered, and inspect the substrates.

D. Verify substrates are smooth, level, at required finish elevation, and are ready to receive resilient tile flooring.

E. Verify that subfloor is clean, flat, smooth, free of dirt, rust, paint, oil, wax or any contaminant that will interfere with adhesive bonding.

F. Mechanically remove substrate coatings that are not compatible with adhesives, such as sealers, curing, hardening or parting compounds, soap, wax, oil, etc.
   a) Do not use solvents or adhesive removers.

G. Expansion joints, isolation joints, or other moving joints must be honored and not be filled with underlayment products or other materials, and floor coverings must not be laid over them. Expansion joint covering systems should be detailed by the architect or engineer based upon intended usage and aesthetic considerations.

H. Surface cracks, grooves, depressions, control joints or other non-moving joints, and other irregularities shall be filled or smoothed with high quality Portland Cement or Calcium Aluminate based patching or underlayment compound for filling or smoothing, or both.
   a) Do **NOT** skim-coat large areas with patching compound, especially slick power-troweled surfaces.

   b) Sand smooth per manufacturer's instructions.

I. Slick surfaces such as power troweled concrete shall be profiled as needed to allow for a mechanical bond between the adhesive and subfloor.
   Note: Do not use gypsum-based underlayment products and do not skim coat concrete subfloors.

J. Self-leveling underlayments: Provide a dry and smoothly-sanded underlayment substrate ready for installation of Luxury Vinyl Plank & Tile. Underlayment compound shall be moisture-resistant, mildew-resistant, and alkali-resistant and must have 3,000 psi compressive strength per ASTM C109.

K. Lightweight concrete shall have a compressive strength greater than 90lbs per cubic foot with minimum compression strength of 2,500 psi or greater.

L. Wood Substrates or Panel Type Underlayment:
   a). Wood subfloors require an underlayment (double layer construction) with a minimum total thickness of 1” (25mm) and minimum of 18" of well ventilated space beneath.
      1) Crawl spaces shall be insulated and protected by a vapor barrier.

   b). Use minimum ¼” (6mm) thick APA rated “underlayment grade” plywood with a fully sanded face or other underlayment panel that is appropriate for the intended usage. Install and prepare panels and seams according to the manufacturer’s instructions.

M. Existing and other substrates:
   a). Refer to manufacturer's professional installation guide and or contact manufacturer, as special conditions may exist.

N. Bring discrepancies to the attention of the Architect and do not proceed until such discrepancies are corrected.

O Conduct moisture test in accordance with ASTM F1869 - maximum allowable amount of moisture emission from floor is 3.0 pounds per 1,000 square feet in 24 hour period, and shall not exceed maximum allowable moisture content as allowed by flooring manufacturer.

P. Starting Work indicates acceptance of existing conditions.

3.3 INSTALLATION

A. General:
1. Install materials only after finishing operations, including painting, have been completed and after permanent heating and cooling system is operating.

2. Verify that moisture content of concrete slabs, building air temperature, and relative humidity are within the limits recommended by the manufacturers of the materials used.

B. Adhesives: Adhere flooring to substrate using the full spread method resulting in a completed installation without gaps, voids, raised edges, bubbles or any other surface imperfections.
1. Select appropriate Adhesive, trowel and follow manufacturer's instructions.

2. Periodically spot-check transfer of adhesive to back of tile during installation.

3. Roll floor with a 100lbs. roller to ensure proper transfer of adhesive and bonding.

4. Protect floor from traffic per manufacturer's instructions.

C. Installing Tiles/Planks:
1. Place units with adhesive cement in compliance with the manufacturer's recommendations.
   a. Butt units tightly to vertical surfaces, nosings, edgings, and thresholds.
   b. Scribe as necessary around obstructions and to produce neat joints.
   c. Place tiles tightly laid, even, and in straight parallel lines.
   d. Place planks tightly laid, random placement with parallel lines.
   e. Extend units into toe spaces, door reveals, and in closets and similar spaces.

2. Lay units from center marks established with principal walls, discounting minor offsets, so that units at opposite edges of the room are of equal width.
   a. Adjust as necessary to avoid use of cut widths less than 3 inches wide at edge of space.
   b. Lay units square to axis of the room or space.

3. Match units for color and pattern by using materials from cartons in the same sequence as manufactured and packaged.

4. Place joining and edge finish moldings, including reducer strips tightly butted to units and secured with adhesive, providing at all unprotected edges unless otherwise shown.

3.4 FIELD QUALITY CONTROL

A. Inspect flooring installation for non-conforming work including but not limited to the following:
1. Lack of adhesion.
2. Bubbles, loose tiles or raised edges.
3. Dirt and debris underneath flooring.
4. Excessive gaps.
5. Improper substrate preparation as indicated by telegraphing.
6. Damage to tiles, including: dents/indentations, cuts, cracks, burns or punctures.

B. Non-conforming work per General Conditions and as follows: Repair or replace damaged material if not acceptable to the Architect.

3.5 CLEANING AND PROTECTING

A. Remove excess adhesive and other blemishes from exposed surfaces, using neutral cleaner recommended by the manufacturer of the resilient materials.

B. Coordinate material reclamation program with manufacturer, if applicable.
   1. Store and return cartons and pallets to manufacturer or recycler for reuse or recycling.

C. Provide Progress Cleaning per manufacturer's written instructions, and as follows:
   1. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
      a. Clean and protect completed construction until Substantial Completion.
      b. During installation, remove wet adhesive from surface of flooring per manufacturer's instructions.

   2. Site: Maintain Project site free of waste materials and debris.

D. Provide Final Cleaning immediately prior to Substantial Completion inspection per manufacturer's written instructions, and SECTION 01 7000 or 01 7400 or 01 7423.
   1. Protection: Remove manufacturer's and other installed protection immediately prior to Substantial Completion inspection, unless required otherwise.

   2. Clean floor with a neutral 6-8 pH cleaner.

3.6 MAINTENANCE

A. Initial maintenance per flooring manufacturer’s written instructions and as follows:
   1. Allow the adhesive to cure for at least 48 hours prior to wet cleaning the floor.
   2. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dirt, dust, grit and debris.
   3. Remove any dried adhesive residue from the surface with Black Scuff and Adhesive Remover or mineral spirits applied to a clean, lint-free cloth.
   4. Damp mop the floor using a Cleaner recommended by the flooring Manufacturer.

   5. If necessary, scrub the floor using an auto scrubber or rotary machine, (300 rpm or less) with a Cleaner recommended by the flooring Manufacturer... using the proper dilution ratio and the appropriate scrubbing brush or pad.
   6. Thoroughly rinse the entire floor with fresh, clean water. Remove the dirty residue with a wet-vacuum or clean mop and allow the floor to dry completely.

3.7 PROTECTION

A. Protect materials from construction operations until date of Final Completion or Owner occupancy, whichever occurs first.
   1. Protect finished floor from abuse and damage by using heavy non-staining kraft paper, drop cloths or equivalent. Use additional, non-damaging protective materials as needed.
   2. Light foot traffic on a newly installed floor can be permitted after 24 Hours
   3. Keep heavy traffic and rolling loads off the newly installed LVT flooring for 48 hours
   4. Protect the floor from rolling traffic by covering with protective boards.

END OF SECTION 09 65 25

SECTION 09 66 13 PORTLAND CEMENT TERRAZZO FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Poured-in-place portland cement terrazzo flooring.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include terrazzo installation requirements. Include plans, sections, component details, and relationship to other work.

C. Samples: For each exposed product and for each color and texture specified.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material certificates.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An installer who is a contractor member of NTMA.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.2 PORTLAND CEMENT TERRAZZO

A. Portland Cement Terrazzo System: Sand cushion.

1. Underbed Thickness: As indicated on Drawings.
2. Terrazzo Topping Thickness: 1/2”.

B. Materials:

1. Portland Cement: ASTM C150/C150M, Type 1.

    a. Color for Terrazzo Matrix: As required by mix indicated.

2. Water: Potable.
3. Sand: ASTM C33/C33M.
4. Aggregates: Comply with NTMA gradation standards for mix indicated and contain no deleterious or foreign matter.

    a. Abrasion and Impact Resistance: Less than 40 percent loss per ASTM C131/C131M and ASTM C535 for large-size coarse aggregates.
    b. 24-Hour Absorption Rate: Less than 0.75 percent.
    c. Dust Content: Less than 1.0 percent by weight.
5. Matrix Pigments: Pure mineral or synthetic pigments, alkali resistant, durable under exposure to sunlight, and compatible with terrazzo matrix.
6. Underbed Bonding Agent: Neat portland cement paste.
7. Underbed Reinforcement: Galvanized welded-wire reinforcement, wire 2 by 2 inches (51 by 51 mm) by 0.062 inch (1.57 mm) in diameter, complying with ASTM A1064/A1064M, except for minimum wire size.
8. Isolation Membrane: Polyethylene sheeting, ASTM D2103, Type 13300, 4 mils (0.1 mm) thick; or unperforated asphalt felt, ASTM D226/D226M, Type I (No. 15).

C. Mixes:

1. Underbed Mix: One part portland cement to four parts sand and sufficient water to provide workability at as low a slump as possible.
2. Terrazzo Topping Mix: One 94-lb (42.6-kg) bag of portland cement per 200 lb (90.7 kg) of aggregate, matrix pigment if required by mix color, and sufficient water to produce a workable mix.

    a. Mix Color and Pattern: As selected by Architect.

2.3 STRIP MATERIALS

A. Standard Divider Strips: One-piece, flat-type strips for grouting into sawed joints prepared in substrate.

1. Material: White-zinc alloy.
2. Depth: As indicated.
3. Width: 1/8 inch (3.2 mm).

B. Control-Joint Strips: Separate, double L-type angles, positioned back to back, that match material and color of divider strips and in depth required for topping thickness indicated.

C. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Use the following types of accessory strips as required to provide a complete installation:
   1. Base-bead strips for exposed top edge of terrazzo base.
   2. Edge-bead strips for exposed edges of terrazzo.

2.4 MISCELLANEOUS ACCESSORIES

A. Strip Adhesive: Recommended by manufacturer for this use.

B. Anchoring Devices: Provide mechanical anchoring devices or adhesives for strip materials as recommended by manufacturer and as required for secure attachment to substrate.

C. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

D. Isolation and Expansion-Joint Material: Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, and non-outgassing in unruptured state; butyl rubber; rubber; or cork; minimum 1/2 inch (12.7 mm) wide.

E. Portland Cement Terrazzo Cleaner: Chemically neutral cleaner with pH factor between 7 and 10 that is biodegradable, phosphate free, and recommended by cleaner manufacturer for use on terrazzo type indicated.

F. Sealer: Slip- and stain-resistant, penetrating-type sealer that is chemically neutral; does not affect terrazzo color or physical properties; is recommended by sealer manufacturer; and complies with NTMA's written recommendations for terrazzo type indicated.
   1. Surface Friction: Not less than 0.6 according to ASTM D2047.
   2. Acid-Base Properties: With pH factor between 7 and 10.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Clean substrates of substances, including oil, grease, and curing compounds, that might impair terrazzo bond. Provide clean, dry, and neutral substrate for terrazzo application.

   1. Roughen concrete substrates before installing terrazzo system according to NTMA's written recommendations.

B. Comply with NTMA's written recommendations for terrazzo and accessory installation.

C. Installation Tolerance: Limit variation in terrazzo surface from level to 1/4 inch in 10 feet (6.4 mm in 3 m); noncumulative.

D. Underbed:

   1. Comply with NTMA's written recommendations for underbed installation.
   2. Sand-Cushion Portland Cement Terrazzo:

      a. Cover entire surface to receive terrazzo with dusting of sand.
      b. Install isolation membrane over sand, overlapping ends and edges a minimum of 3 inches (75 mm).
      c. Install welded-wire reinforcement, overlapping at edges and ends at least two squares. Stop mesh a minimum of 1 inch (25 mm) short of expansion joints.

3. Bonded Portland Cement Terrazzo:

   a. Saturate structural concrete substrate with water, and slush and broom with underbed bonding agent.

4. Place underbed and screed to elevation indicated below finished floor elevation.

E. Strip Materials:

1. Divider and Control-Joint Strips:

   a. Locate divider strips directly over breaks and control joints in concrete slabs and in locations indicated directed by Architect.
   b. Install control-joint strips back to back and directly above concrete-slab control joints and in locations directed by Architect.

      1) Install control-joint strips with 1/4-inch (6.4-mm) gap between strips, and install sealant in gap.

   c. Install strips in adhesive setting bed without voids below strips, or mechanically anchor strips as required to attach strips to substrate, as recommended by strip manufacturer.

2. Accessory Strips: Install as required to provide a complete installation.

3.2 POURED-IN-PLACE TERRAZZO INSTALLATION

A. Underbed Preparation:
1. Sand-Cushion Portland Cement Terrazzo: Saturate underbed with water to produce a cement slurry.
2. Bonded Portland Cement Terrazzo: Dampen underbed with water.

B. Place terrazzo mixture in panels formed by divider strips and trowel mixture to top of strips. Seed additional aggregates in matrix to uniformly distribute granular material and produce a surface with a minimum of 70 percent aggregate exposure. Roll and compact surface until excess cement and water have been extracted.

1. Portland Cement Terrazzo: Trowel to a dense, uniform, flat surface disclosing lines of divider strips.

C. Portland Cement Terrazzo Base: Install and finish base at the same time that adjacent flooring is installed.

D. Portland Cement Terrazzo Finishing: Cover terrazzo topping with moisture-retaining cover and cure until topping develops sufficient strength to prevent lifting or pulling of aggregate during grinding.

1. Rough Grinding: Grind with 24-grit or finer stones or with comparable diamond plates.
2. Grouting: After rough grinding, clean terrazzo topping with water and rinse away residue. Remove excess rinse water, apply matrix mix to grout surface, and fill voids. After grouting, cover surface with moisture-retaining cover to cure grout until ready for fine grinding.
3. Fine Grinding and Polishing: Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted. Grind with 80-grit stones or with comparable diamond abrasives until grout is removed from surface.

E. Cut out and replace terrazzo areas that evidence lack of bond with substrate or underbed, including areas that emit a "hollow" sound if tapped. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.3 CLEANING AND PROTECTION

A. Terrazzo Cleaning:

1. Remove grinding dust from installation and adjacent areas.
2. Wash surfaces with cleaner immediately after final cleaning of terrazzo flooring according to both NTMA's and manufacturer's written recommendations and manufacturer's written instructions; rinse surfaces with water and allow them to dry thoroughly.

B. Sealing:

1. Seal surfaces according to NTMA's written recommendations.
2. Apply sealer according to sealer manufacturer's written instructions.

END OF SECTION 09 66 13

SECTION 09 67 23 RESINOUS FLOORING

PART I - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Definitions: Resinous flooring includes penetrating two-component epoxy primer, three-component mortar consisting of epoxy resin, curing agent and finely graded quartz silica aggregate, three-component, epoxy undercoat, brightly colored, quartz silica aggregate broadcast and a high performance, two-component, clear epoxy sealer. CUSTOM COLORS ARE REQUIRED FOR ALL SELECTIONS ON THIS PROJECT!

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.

B. Samples: Submit, for verification purposes, 4-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.

1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain primary resinous flooring materials including primers, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least five projects of similar size and complexity; Stonhard or approved equal. Provide secondary materials only of type and from source recommended by manufacturer of primary materials.

B. Pre-Installation Conference
1. General contractor shall arrange a meeting not less than thirty days prior to starting work.
2. Attendance
   a. General Contractor
   b. Architect/Owner's Representative
   c. Manufacturer/Installer's Representative

C. ISO 9002: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9002 registered quality system.

1.05 DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.

B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches to eliminate on site mixing errors. No on site weighing or volumetric measurements allowed.

C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 85°F/16 and 30°C.

1.06 PROJECT CONDITIONS

A. Concrete substrate shall be properly cured for a minimum of 30 days. A vapor barrier must be present for concrete subfloors on or below grade. Otherwise, an osmotic pressure resistant grout must be installed prior to the resinous flooring.

B. Utilities, including electric, water, heat (air temperature between 60 and 85°F/16 and 30°C) and finished lighting to be supplied by General Contractor.

C. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

D. Protection of finished floor from damage by subsequent trades shall be the responsibility of the General Contractor.

1.07 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering both material and workmanship for a period of one (1) full year from date of installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

1. Acceptable Manufacturers:
   a. Stonhard Inc. – Basis of Design:
      CUSTOM COLORS ARE REQUIRED FOR ALL SELECTIONS ON THIS PROJECT!
   b. Arizona Polymer Flooring, Inc.
   c. Duraflez, Inc.
   d. Sika Corporation Flooring

2.02 COLORS

A. Colors: As selected by Architect from manufacturer's standard colors.

2.03 EPOXY FLOORING (RES)

A. Basis of Design - Stonshield HRI as manufactured by The Stonhard Group, Inc., Maple Shade, NJ, (800) 257-7953 is a nominal 3/16"/5mm thick flooring system with a decorative, slip resistant surface comprised of a penetrating two-component epoxy primer, three-component mortar consisting of epoxy resin, curing agent and finely graded silica aggregate, three-component, epoxy undercoat, brightly colored, quartz silica aggregate broadcast and a high performance, two-component, clear epoxy sealer. Dex-O-Tex (Cheminert CFS) and Arizona Polymer Flooring (Amror-Rez HD 135) are approved manufacturers.

1. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

Compressive Strength	10,000 psi	(ASTM C-579)

Tensile Strength	2,000 psi	(ASTM C-307)
Flexural Strength	4,300 psi	(ASTM C-580)
Hardness	85-90	(ASTM D-2240/Shore D Durometer)
Bond Strength	>400 psi	(ASTM D-4541) (100% conc. failure)
Impact Resistance	>160 in. lbs.	(ASTM D-4226)
Abrasion Resistance	0.06 gm max. weight loss (ASTM D-4060, Taber Abrader CS-17 wheel)	
Coefficient of Friction	0.7-0.8	(ASTM D-2047)
Flexural Modulus of Elasticity	2.0 x 10^6 psi	(ASTM C-580)
Flammability	Self Extinguishing (ASTM D-635) Extent of burning 0.25 inches max.	
Thermal Coefficient of Linear Expansion	1.8 x 10^{-5} in/in°C	(ASTM C-531)
Water Absorption	0.1%	(ASTM C-413)
Heat Resistance Limitation	140°F/60°C 200°F/93°C	(for continuous exposure) (for intermittent spills)
Cure Rate, allow:	8 hours for foot traffic (at 77°F/25°C) 18 hours for light traffic 24 hours for normal operations	

2.03 JOINT SEALANT MATERIALS

A. Type produced by manufacturer of resinous flooring system for type of service and joint condition indicated.

2.04 COVED BASE

1. Ceramic Wall Tile to Resinous Floor: Integral Resinous Coved Base:

2. Bottom Edge of Thin-Set Mortar Installations @ Resinous Coved Base: Provide Schluter® “Jolly” edge protection profile (anodized aluminum finish); confirm trim size/height needed with thickness of tile. Provide inside/outside corner pieces and connectors from manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. Substrate: Concrete preparation shall be by mechanical means and include use of a scabbler, scarifier or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.02 APPLICATION

A. General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

B. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate.

C. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using steel finishing trowels or power trowel material.

D. Undercoat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.

E. Broadcast: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spraycaster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

F. Sealer: Remove excess unbonded granules by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures.

3.03 FIELD QUALITY CONTROL

A. The right is reserved to invoke the following material testing procedure at any time, and any number of times during period of flooring application.

B. The Owner will engage service of an independent testing laboratory to sample materials being used on the job site. Samples of material will be taken, identified and sealed, and certified in presence of Contractor.

C. Testing laboratory will perform tests for any of characteristics specified, using applicable testing procedures referenced herein, or if none referenced, in manufacturer's product data.

D. If test results show materials being used do not comply with specified requirements, Contractor may be directed by Owner to stop work; remove non-complying materials; pay for testing; reapply flooring materials to properly prepared surfaces which had previously been coated with unacceptable materials.

3.04 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning materials and procedures recommended by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 68 16 CARPET

PART 1 - GENERAL

1.01 SCOPE

A. Provide and install all carpet and accessories, adhesives and resilient base required for a complete installation at locations indicated on the drawings.

1.02 SUBMITTALS

A. Product Data:

1. Manufacturer's product data, including base adhesive.
2. Manufacturer's installation instructions.
3. Manufacturer's maintenance instructions.

B. Samples:

1. Submit two (2) samples showing manufacturer's colors (12 inches by 12 inches) for Architect's selection and approval.

2. Submit actual base and accessory samples in complete range of manufacturer's standard colors for Architect's selection and approval.

3. Submit actual sample of carpet in approved color from loom to produce run of carpet.

C. Shop Drawings: Showing layout of all seams and cross seams, and location and type of carpet accessories.

D. Certificate: Showing manufacturer's loom on which carpet will be produced and date of last inspection for specification tolerances.

E. Closeout Submittals

1. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.

2. Operation and Maintenance Data: Submit maintenance procedures, including:

a) Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.

b) Precautions for cleaning materials and methods that could be detrimental to carpet.

1.04 QUALITY ASSURANCE

A. Installer: A firm with not less than 5 years experience in installation of commercial carpet by methods similar to those required for this project.

B. All materials shall be installed by workmen skilled in the carpet trade and shall meet or exceed the highest standards of the carpet industry.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified In this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section and is approved by manufacturer.

1. FCIB or IFCI certified carpet installers, or demonstrate compliance with certification program requirements.

1.06 PRE-INSTALLATION MEETINGS

A. Convene minimum one week prior to commencing work of this section.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Store materials in area of installation for 48 hours prior to installation.

B. Do not install carpet until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

C. Do not install carpet over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet manufacturer.

1.08 EXTRA MATERIALS

A. Supply extra carpet, full width rolls in protective wrap in the amount of 5 percent of the amount installed for each type and color but not less than 10 sq. yds.

1.09 DELIVERY, STORAGE AND PROTECTION

A. Deliver carpet in rolls covered with original mill protective wrapping and in sealed cartons with register number tags attached to each roll or carton. Deliver tags to the architect along with a sample of carpet cut from each roll.

B. Store carpet raised above floor, under cover, in well ventilated spaces as soon as delivered.

C. Protect carpet from damage, dirt, stains, and moisture.

D. Environmental Conditions: Building and carpet materials shall be heated at a minimum of 65°F for at least 24 hours prior to installation with the relative humidity not more than 65%. Keep temperature at same level night and day during installation and for at least 40 hours after completion of installation. A minimum temperature of 50°F shall be maintained thereafter.

1.10 MANUFACTURER'S WARRANTY

A. Manufacturer shall provide limited lifetime warranty

B. Guarantee shall provide for replacement of defective work at no cost to owner.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Basis of Design:
1. Tarkett
2. Substitutions: Refer to section 01 25 13

2.02 CARPET

A. Carpet to be Powerbond Hybrid Carpet
B. Substitutions: Refer
C. Description:
1. Pattern Type Organic
2. Pattern Match Not Required
3. Pattern Length 117 "
4. Pattern Width 72 "
5. Stitches per inch 10 /in
6. Pile Thickness (ASTM D5848) 0.075 " (1.93 mm)
7. Soil/Stain Protection Technology ECO ENSURE
8. Stain Resistance (AATCC 175-08)
9. Dye Method Solution dyed
10. Fiber System 506
11. Backing Options FLEX-AIRE CUSHION
12. Flammability (ASTM E648)
13. Smoke Density (ASTM E662)

2.03 ACCESSORIES

A. Edge Strips at all carpet to tile joints: Metal strip edge protection and transition strips as manufactured by Schluter Systems, LP. www.schluter.com

1. RENO-U or RENO-RAMP type, satin anodized aluminum, profile with sloped exposed surface, 1/8” tall leading edge, integrated trapezoid-perforated anchoring leg and integrated joint spacer

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Prior to installation, inspect sub-flooring for cracks, holes, abrasions, rough spots, and ridges and be sure floor has been cleaned of dust, dirt, solvents, oil, grease, paint, plaster, wax and other substances detrimental to proper performance of adhesive and carpet or other conditions that will adversely affect execution and quality of work. Report discrepancies in writing to general contractor or owner with copies to architect.

B. Concrete slabs shall be aged 60 days minimum. Perform moisture test on concrete and obtain acceptable results. See manufacturer’s specifications for porosity of floor.

C. Fill depressions, holes, and cracks with latex underlayment. Do not use a water base “floor stone” product. Trowel and featheredge underlayment to a smooth and level surface. Grind down high spots and finish with underlayment. Finish floor level to within 1/8” in 10 feet. Do not proceed until defects are corrected.

D. Carefully check dimensions and other conditions in facilities and be responsible for proper fitting of carpet in areas designated.

E. Do not proceed until defects are entirely corrected. Application or installation of carpet shall constitute acceptance of substrates.

3.02 INSTALLATION

A. All materials shall be installed by qualified carpet mechanics under proper supervision. Prior to installation, all floor irregularities shall be repaired and the floor shall be thoroughly cleaned with all grit and dirt removed before carpet is laid.

B. Lay carpet on floors with the run of the pile in same direction as anticipated traffic flow.

C. Do not change run of pile on any one room or from one room to next where continuous through a wall opening. If multiple wall openings exist, lay carpet with run of pile continuous through openings with heaviest anticipated traffic flow.

D. Use manufacturer's recommended adhesive.

E. Install carpet in accordance with manufacturer's recommended procedures.

G. At columns and other penetrations, cut carpet with maximum possible overage. Position the seams made by these cuts first.

J. Neatly trim edgings of carpet for tight fit to walls and base; cut and fit evenly around projections and into trim strips.

K. Fit closely and evenly to, in, and through doorways, terminating carpet under doors.

L. Lay carpet with a minimum of seams in accordance with approved shop drawings. Do not use small carpet to fill strips. Do not place seams perpendicular to doors or entries. Minimize seams in traffic lanes. Do not install carpet from different dye lots adjacent to or abutting each other in the same areas. Materials abutting one another shall have no noticeable variation in color.

M. Cross joints necessary due to layout of areas shall be at absolute minimum.

N. Cross joints necessary due to length of rolls received shall be placed in cutting to avoid occurrence at conspicuous locations, near doors, or at pivot points.

O. Install edge strip where carpet meets other flooring materials, including door opening locations. Trim toe of reducer to same thickness as adjacent flooring material. Use full length pieces only. Butt tight to vertical surfaces. Where splicing cannot be avoided, butt end and flush.

P. Place seams in non-conspicuous locations. Neatly cut carpet around floor openings, electrical outlets and other projections. Leave finished installation smooth and free of ripples, puckers or other defects.

3.03 PROTECTION AND CLEANING

A. After carpet installation is completed, remove remnants, wrapping paper and debris.

B. Remove loose pieces of yarn with sharp scissors.

C. Remove soiled spots from carpet using proper spot remover.

D. Clean carpet with commercial beater bar type vacuum cleaner.

E. Repair any damages or stains to adjacent materials caused by installer or his workmen.

F. Do not place heavy objects such as furniture on carpet surfaces for minimum of 24 hours or until adhesive is set. Replace carpet displaying adhesive “bleed through.”

3.04 PRECAUTIONS

A. Precautions shall be taken to protect work performed or completed by other trades.

B. The carpet installer shall be responsible for his damages to work of other trades.

C. The carpet subcontractor shall inspect all surfaces to receive carpet prior to the beginning of any carpet installation and shall notify the general contractor and the architect, in writing, of any surfaces not properly prepared. Installation of carpeting assumes responsibility by carpet subcontractor of any defects of surface below.

D. Appropriate equipment will be used during the installation per manufacturer’s recommendation.

E. Upon completion of the total installation of carpeting, the carpet shall be smooth, uniform, pattern-matched, and thoroughly cleaned in every respect. All remnants and scraps smaller than 3’ x 3’ shall be removed from the job site.

F. Maintenance Manuals: The carpet installer shall furnish the owner an electronic pdf copy of the manufacturer’s recommendation for the care, cleaning, and maintenance for the carpet furnished. After installation is completed, the carpet installer shall instruct the owner’s maintenance personnel in the care, cleaning, and maintenance of the installed carpet.

END OF SECTION 09 68 00

SECTION 09 72 00 PRESENTATION DRY ERASE WALLCOVERING

PART 1 GENERAL

1.01 SUMMARY

A. Division Includes:
   1. Magnetic Receptive Dry Erase Wallcovering.
   2. Tray and Trim
   3. Accessories.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
   E84 Test Method for Surface Burning Characteristics of Building Materials.
B. Gypsum Association
   GA-214-M-97 Recommended Levels of Gypsum Board Finish.

1.03 SUBMITTALS

A. Manufacturer's product data and installation instructions for each type of dry erase wallcovering, adhesive, and accessories required.
B. Manufacturer's written product data indicating compliance with specified materials required.
C. Manufacturer's written installation instructions.
D. Manufacturer's written instructions for recommended maintenance of each type of dry erase wall covering required.
E. Samples:
   1. 7 inch (177.8mm) x 9 inch (228.6mm) samples of each dry erase material required.
   2. 6 inch (152.4mm) samples of trim, tray, and end caps required.

1.04 QUALITY ASSURANCE

A. Manufacturer: Provide each type of dry erase wallcovering required produced by one manufacturer.
B. Installer: Installation by skilled commercial wallcovering contractor with no less than three years of documented experience installing dry erase wallcovering of the types and extent required.
C. Surface Burning Characteristics Classification: Provide materials that meet Class I/A rating when tested in accordance with ASTM E84 for flame spread and smoke developed
D. Field Samples: Prepare field samples for architect's review and establish requirements for seaming and finish trim.
   1. Install sample panel of each type presentation wallcovering specified in area designated by architect.
   2. Maintain corrected and approved samples to serve as a standard of performance for the project.

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver presentation wallcoverings to the project site in unbroken and undamaged original factory packaging and clearly labeled with the manufacturer's identification label, quality or grade, and lot number.
B. Store materials in a clean, dry storage area with temperature maintained above 55°F (13°C) with normal humidity.
C. Store material within original packaging to prevent damage.

1.06 PROJECT CONDITIONS

A. Do not apply presentation wallcoverings when surface and ambient temperatures are outside the temperature ranges required by the wallcovering manufacturer.

B. Provide continuous ventilation and heating facilities to maintain substrate surface and ambient temperatures above 55°F (13°C) unless required otherwise by manufacturer's instructions.
C. Apply adhesive when substrate surface temperature and ambient temperature is above 55°F (13°C) and relative humidity is below forty percent.
D. Maintain constant recommended temperature and humidity for at least 72 hours prior to and throughout the installation period, and for 72 hours after wallcovering installation completion.
E. Provide not less than 80-foot-candles per square foot lighting level measured mid-height at substrate surfaces.

1.07 WARRANTY

Submit manufacturer's limited ten-year written warranty against manufacturing defects.

1.08 MAINTENANCE

Maintenance instructions: Include precautions against cleaning materials and methods that may be detrimental to finishes and performance.

PART 2 PRODUCTS

2.01 MANUFACTURER

Basis of Design: Walltalkers MagRite Wallcoverings by Koroseal Interior Products

2.02 MATERIALS

A. Walltalkers Matte-Rite: Specify backing: non-woven or adhesive backing with white pigmented vinyl capped with matte, projectable, dry erase film.
1. MA50: 49/50 inch (1.25/1.27m) width, self-adhesive backing, white only.

2.03 TRIM & TRAY

A. Aluminum Tray: Clear satin, anodized aluminum, snap-on marker and eraser tray with clips. Specify length: 4' length (TY04-00)
B. End Caps:
1. ET03-00: 1/2 inch (13mm) anodized tray end cap set for marker and eraser tray.

C. J Cap Wallcovering Trim: JC12-00: Clear satin, anodized aluminum, low profile trim Also available in Black and White powder coat

2.04 ACCESSORIES

A. Adhesives: Heavy-duty clear or clay based premixed vinyl adhesive.
B. Substrate Primer/Sealer: White pigmented acrylic base primer/sealer specifically formulated for use with vinyl wallcoverings.
C. Aluminum Marker Caddy: Provide 3 inch (76 mm) high x 7-1/4 inch (184 mm) wide aluminum caddy with four holes and a slot for storing markers and an eraser.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 4 finish, per GA-214-M-97: Recommended Levels of Gypsum Board Finish, and permanent lighting should be installed and operational.
B. Test substrate with suitable moisture meter and verify that moisture content does not exceed four percent.
C. Verify substrate surface is clean, dry, smooth, structurally sound, and free from surface defects and imperfections that would show through the finished surface.
D. Evaluate all painted surfaces for the possibility of pigment bleed-through.

E. Notify the contractor and architect in writing of any conditions detrimental to the proper and timely completion of the installation.
F. Beginning of installation means acceptance of surface conditions

3.02 INSTALLATION: WALLCOVERING BACKING

A. Acclimate wallcovering in the area of installation a minimum of 24 hours before installation.
B. Read and follow the manufacturer's installation instruction sheet contained in each roll of the dry erase wallcovering.
C. Examine all materials for pattern, color, quantity and quality, as specified for the correct location prior to cutting.
D. Install each strip horizontally and in the same sequence as cut from the roll.
E. Install dry erase wallcovering sheets in exact order as they are cut from bolt. Reverse hang alternate strips (except lined products). Do not crease or bend the wallcovering when handling.
F. Install dry erase wallcovering horizontally using a level line.
G. Using a level or straight edge, double cut the seam with a seam-cutting tool (Ex: Double Seam-Cutter or Swedish Knife). Do not score drywall or plasterboard when cutting material.
H. When covering the entire wall, seam the material out of the main writing and viewing areas of the wall.
I. Apply wallcovering to the substrate using a wallcovering smoother, wrapped with a soft cloth, to remove air bubbles. Do not use sharp edged smoothing tools. Smooth material on the wall from the middle to the outside edge.
J. Remove excess adhesive immediately after the wallcovering is applied. Clean entire surface with a warm mild soap solution, and clean soft cloths. Rinse thoroughly with water and let dry before using. Change water often to maintain water clarity.
M. Stop installation of material that is questionable in appearance and notify the manufacturer's representative for an inspection.

3.03 CLEAN-UP

A. Upon completion of installation, remove all exposed adhesive immediately using a soft cloth and a warm, mild soap solution and rinse thoroughly with water and dry with clean towel prior to using.
A. Upon completion of the work, remove surplus materials, rubbish, and debris resulting from the wallcovering installation. Leave areas in neat, clean, and orderly condition.

END OF SECTION

SECTION 09 72 00 WALL COVERING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Vinyl wall covering.

1.02 SUBMITTALS

A. Shop Drawings: Indicate wall elevations with seaming layout.

B. Product Data: Submit data on covering and adhesive.

C. Samples: Submit two samples of covering, 12 x 12 inch in size illustrating color, finish, and texture.

D. Manufacturer's Installation Instructions: Submit special procedures and perimeter conditions requiring special attention.

1.03 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

1.04 QUALITY ASSURANCE

A. Surface Burning Characteristics:

1. Textile Wall Coverings: Comply with one of the following:

a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

b. Comply with requirements of applicable code when tested in accordance with NFPA 265 Method A or Method B test protocols.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section and approved by manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials on site to verify acceptance.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 EXTRA MATERIALS

A. Supply 25 linear feet of each color and pattern of covering; store where directed.

B. Package and label each roll by manufacturer, color and pattern, and destination room number.

PART 2 PRODUCTS

2.01 MANUFACTURERS

1. Momentum Textiles & Wallcovering; Momentum
2. Koroseal Wallcovering, Desert Sand, Type 2, www.koroseal.com
3. Substitutions: Refer to section 01 25 13

2.02 WALL COVERING

A. Wall Covering (VWC-1, VWC-2):
   1. Manufacturer: Momentum
   2. Description: Type II, W-101 (Fed. Spec. CCC-W-408A/D)
   3. Weight: 35 oz.
   4. Width: 52/54"
   5. Content: 100% vinyl
   6. Backing: Cotton scrim
   7. Installation: Non-reverse hang, random match
   8. Repeat: -
   9. Flame Resistance: ASTM E84 Class A, CAN/ULC S102
   10. Permeability: Specify microventing as an added feature for breathability
   11. Maintenance: Warm water, mild soap
   12. Pattern and Color: Refer to Material Schedule on drawing sheet A9.00.

B. Wall Covering (VWC-3, VWC-4):
   1. Manufacturer: Koroseal
   2. Material: Vinyl
   3. Backing: Woven
   4. Pattern Match: Random Match, Reverse Hang
   5. Roll Width: 52-54 in (132-137 cm)
   6. Fire Rating: Class A ASTM E-84
   7. Vertical Repeat: N/A in (0 cm)
   8. Horizontal Repeat: N/A in (0 cm)
   9. Pattern and Color: Refer to Material Schedule on drawing sheet A9.00.

C. Adhesive: Type recommended by covering manufacturer to suit application to substrate; mildew-resistant, non-staining.

D. Release Coat: Provide sealer or undercoat for new gypsum wallboard substrates as recommended by wallcovering manufacturer.

E. Substrate Filler: As recommended by adhesive and covering manufacturers; compatible with substrate.

F. Substrate Primer and Sealer: Alkyd enamel type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify substrate surfaces are prime painted and ready to receive work, and conform to requirements of covering manufacturer.

B. Measure moisture content of surfaces using electronic moisture meter. Do not apply coverings unless moisture content of surfaces are below the following maximums:

1. Plaster and Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Unit Masonry: 12 percent.
3. Wood Surfaces: 15 percent, measured in accordance with ASTM D4442.

C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at rate greater than 1/16 inch/ft.

3.02 PREPARATION

A. Fill cracks in substrate and smooth irregularities with filler; sand smooth.

B. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize-, wipe dry.

C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

D. Surfaces: Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

E. Completely remove any existing wall covering finish where new wall covering is to be installed.

F. Marks: Seal with shellac those surfaces which may bleed through surface finishes.

G. Apply primer sealer to substrate surfaces as required, in accordance with manufacturer's instructions. Allow to dry. Lightly sand smooth.

H. At gypboard walls to receive new wallcovering, provide LEVEL 3 finish in accordance with Gypsum Association GA 214, “Recommended Level of Gypsum Board Finish”.

I. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Use covering in roll number sequence- Change run numbers at partition breaks and corners only.

B. Razor trim edges on flat work table, changing blade often to prevent rough cut edges. Do not razor cut on gypsum board surfaces.

C. Apply covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface. Butt edges tight.

D. Horizontal seams are not acceptable.

E. Match pattern 72 inches above finish floor.

F. Do not seam within 2 inches of internal corners or within 6 inches of external corners.

G. Remove excess adhesive while wet from seam before proceeding to next covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean coverings of excess adhesive, dust, dirt, and other contaminants.

C. Reinstall wall plates and accessories removed prior to work of this section.

END OF SECTION 09 72 00

SECTION 09 84 13 FABRIC COVERED ACOUSTIC PANELS

PART 1 - GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install complete acoustical wall panels as shown on plan and called for herein.

B. Provide all labor, equipment, supplies, accessories, and material necessary for the proper installation of acoustical wall panels.

1.02 SITE INSPECTION

A. The Contractor shall visit and examine the site and verify all existing items and familiarize himself with existing work conditions and understand the conditions which affect performance of the work before submitting shop drawings. He shall notify the Architect of any special or existing conditions which may affect the work to be performed.

B. Field Measurements: Check actual wall surfaces by accurate field measurements before fabrication and show recorded measurements on final shop drawings.

1.03 GENERAL REQUIREMENTS/QUALITY ASSURANCE

A. Manufacturer: Shall be a company specializing in manufacturing commercial acoustical wall panels.

1.04 CODES AND REGULATIONS:

A. Comply with the requirements of Occupational Safety and Health Act (OSHA) and all other applicable federal, state, fire, and local codes. All codes and standards shall be per the latest edition with all supplements and official interpretations included.

B. Should the Contractor perform any work that does not comply with the requirements of the applicable building codes, state laws, local ordinances, and industry standards, he shall bear all costs arising in correcting the deficiencies as approved by the school district.

1.05 FIRE PERFORMANCE CHARACTERISTICS

A. Provide test reports verifying flame/fuel/smoke ratings of acoustical wall panels. All materials shall meet or exceed the requirements of and shall be approved by the fire authority having jurisdiction for this location. Unless exceeded by the local fire authority, the minimum requirements of surface-burning characteristics shall be as indicated below and shall be as determined by testing assembled materials composed of facings and backings identical to be used on this project per ASTM-84-81a, by a testing organization acceptable to the authorities having jurisdiction:

1. Flame Spread: Class 1 (25 or less)
2. Smoke Developed: 450 or less

B. All equipment and material shall be rated and U.L. listed.

1.06 NOISE REDUCTION

A. Noise reduction coefficient (N.R.C.) shall be a minimum of 1.00 when tested in accordance with ASTM C423.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical wall panel material from excessive moisture in shipment, storage, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation.

PART 2 - MATERIALS

2.01 PRODUCTS

A. Acoustical Wall Panels Construction and Fabrication:

1. Description:
   a. Content: 100% Polyester
   b. Reduced Environmental Impact: Single Source Fiber Content, NSF 336 Compliant, GREENGUARD Certified
   c. Railroaded: No
   d. Dye: Piece
   e. Backing: None
   f. Finish: PFAS-Free Stain Resistant
   g. Durability: 115,000 * D.R.
   h. Flame Resistance: CA Bulletin 117 2013, UFAC Class 1, NFPA 260 Class 1, ASTM E84
   i. Width: 56"
   j. Color Fastness: A4 - AATCC 16 opt 3, CLASS 4
   k. Weight: 1.23 lb
   m. Maintenance: WS - Water-Based Cleaning Agents or Foam

2. Finish: Panels shall be covered on front face and have all edges wrapped with manufacturer’s standard 100% polyester woven fabric (basis of design = Guilford of Maine). See drawings for location of impact resistant fabric covering; colors to be selected by Architect (multiple colors may be selected). No seams permitted in fabric covering or exposed faces and edges. Covering material shall be adhered to front surface and bonded on all four edges and rear of panel. Material returned on rear of panel shall be a minimum of 1-1/2”. Backing shall be fiberglass scrim (without foil).

3. Mounting: Panels shall be internally reinforced as required for mounting system. Mounting and suspension system and fasteners shall be of types and sizes recommended by the manufacturer for installations indicated.

4. Mounting System: Mechanical system using metal wall track, panel clips, and leveling angle at bottom as required. Provide continuous closure trim to conceal all gaps between panel and wall on bottom and sides of panels. Hook and loop, impaling clips, and magnetic fasteners are not permitted.

5. Dimension: Panel dimension shall be shown on the drawings and finished schedule; thickness shall be minimum 2” thick and/or 4” thick as shown on drawings.

2.02 MANUFACTURER

A. Product/Manufacturer – Basis of Design: Momentum Textiles and Wallcoverings
Momentum

1. Patterns/Colors: Refer to Material Schedule on drawing sheet A9.00

B. The following are also approved manufacturers:

Acoustical Resources, Inc.
P.O. Box 200504
Austin, Texas 78720
(512) 259-5858

Designer Acoustics, Inc.
2070 Five Mile Line Road
Penfield, NY 14526
(716) 385-3320

Lamvin, Inc.
7992 Miramar Road
San Diego, CA 92126-4212
(800) 446-6239

AVL SYSTEMS
www.avlonline.com
800-228-7842

USG Interiors, Inc.
14643 Dallas Parkway, #575
Dallas, Texas 75240
(972) 490-0355

Sound Concepts
5.99 Henry Ave.
Winnepeg Manitoba, Canada, R3A0V1
(612) 473-1334

Decoustics
15 Webster Street
North Tonawanda, NY 14120-5874
(716) 692-6332

2.03 MOUNTING ACCESSORIES:

A. Wall panels shall be back mounted with concealed metal panel clips designed to allow for panel removal with clips of number and size recommended by the manufacturer to adequately support wall panels.

B. Two-part metal clip system shall consist of one clip part mechanically attached to the back of panel and the other to the wall. Clip shall be designed to support panels laterally.

C. Furnish and install manufacturer and owner-approved metal wall anchors to anchor wall clips to CMU walls, gyp. bd. walls, etc.

D. Provide fabric-covered closure trim (to match wall panel finish) to conceal all gaps around perimeter of panels at wall.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and blocking, with installer present, for compliance with requirements for installation tolerances and other conditions affecting fabric covered tack board performance. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Installation shall not begin until all wet work (plastering, concrete, etc.) is completed and dry. Building shall be properly enclosed and under standard occupancy prior to installation.

Maintain humidity and temperature conditions as recommended by the manufacturer for the particular panel finish(es).

C. The contractor shall be responsible for the examination and acceptance of all surfaces and conditions prior to the acoustical panel installation.

3.02 INSTALLATION

A. General: Perform installation in accordance with manufacturer's recommendations and instructions, except where more stringent requirements are shown or specified, and except where project conditions require extra precautions or provisions to ensure satisfactory performance of the work.

B. Install work in accordance with approved shop Drawings.

C. Install fabric covered tack boards in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, and ascribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's written instructions for installation of panels using type of mounting accessories indicated or, if not indicated, as recommended by manufacturer.

D. Construction Tolerances: As follows:

1. Variation from Plumb and Level: Plus or minus 1/32 inch.
2. Variations of Joints from Hairline: Not more than 1/32 inch.

E. Cut units to be at least fifty percent (50%) of unit width with facing material extended over cut edge to match uncut edge. Scribe acoustical wall panels to fit adjacent work; butt joints tightly.

F. Panels shall not twist, warp, bow, or bend after installation. Defective panels shall be replaced at no charge.

3.03 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

C. Remove surplus materials, rubbish, and debris resulting from fabric covered tack board installation, on completion of the Work, and leave areas of installation in a neat and clean condition.

3.04 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure fabric covered tack boards are without damage or deterioration at time of Substantial Completion.

B. Replace panels that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 09 84 13

SECTION 09 90 00 PAINTING AND COATING

PART 1 – GENERAL

1.01 SCOPE

A. Low Emitting Materials: For field applications that are inside the weatherproofing system, 75 percent of all paints and coatings, by volume or surface area, shall comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers" Using CPDH Standard Method v1.2-2017.

B. Emissions and Pollutant Control: Not less than 85 percent of field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.

2. VOC Content shall not exceed limits of authorities having jurisdiction and the following:
    a. Flat Coatings: 50 g/L.
    b. Nonflat Coatings: 100 g/L.
    c. Nonflat- High-Gloss Coatings: 150 g/L.
    d. Dry-Fog Coatings: 150 g/L.
    e. Industrial Maintenance Coatings: 250 g/L.
    f. Pretreatment Wash Primers: 420 g/L.
    g. Primers, Sealers, and Undercoaters: 100 g/L.
    h. Recycled Coatings: 250 g/L.
    i. Rust-Preventative Coatings: 250 g/L.

C. Emissions Requirements: Field-applied paints and coatings that are inside the weatherproofing system shall comply with either of the following:

1. Low-Emitting Materials: VOC emissions shall comply with requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2. VOC content shall not exceed limits of authorities having jurisdiction and the following:
    a. Flat Coatings: 50 g/L.
    b. Nonflat Coatings: 100 g/L.
    c. Primers, Sealers, and Undercoats: 100 g/L.
    d. Shellacs, Clear: 730 g/L.
    e. Shellacs, Pigmented: 550 g/L.

D. VOC Content: For field applications inside the building, wall paints shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits

1. Interior Flat Latex Wall Paint: 50 g/L.
2. Interior Nonflat Latex Wall Paint: 150 g/L.

E. VOC Emissions: For field applications inside the building, wall paints shall contain no more than half of the chronic REL of VOCs when tested in accordance with the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit or 33 mcg/cu. m and that of acetaldehyde shall not exceed 9 mcg/cu. m.

F. Generally or unless noted otherwise, the following surfaces are to be painted/finished (not all surfaces may apply to this project):

1. Exterior surfaces
   a. Concrete Masonry Unit walls
   b. Concrete walls, beams, columns & soffits
   c. Wood siding, trim, frames, doors and sashes
   d. Plaster / stucco walls and soffits
   e. Hardboard siding
   f. Bare metal, primed metal and galvanized metal (unless noted unpainted)
   g. All other surfaces noted on the drawings to be painted
   h. All mechanical grillwork not prefinished and installed by HVAC
   i. Pavement Markings

2. Interior Surfaces
   a. Gypboard, plaster, concrete, concrete masonry walls, ceilings and soffits
   b. Bare metal, primed metal and galvanized metal (unless noted unpainted)
   c. Finish wood trim, paneling and frames (transparent finish)
   d. Wood doors (factory finished)
   e. Wood cabinets and shelving (transparent finish)
   f. Wood floors, railings and handrails (transparent finish)
   g. Pipes, ducts, hangers and supports, equipment and equipment enclosures not factory finished
   h. Access panels
   i. Plywood panelboards for telephone and electrical panels
   j. All other surfaces noted on the drawings to be painted

G. Generally, the following surfaces are NOT to receive paint:

1. Exterior architectural finish concrete masonry and brick (shall receive water repellent)
2. Items specified with factory finish
3. Items indicated to receive other finish
4. Items indicated to remain unfinished
5. Marble, granite, slate and other natural stones
6. Brick, concrete, cast stone, integrally colored concrete and plaster
7. Glass
8. Stainless steel, anodized aluminum, bronze.
9. Equipment nameplates, fire rating labels and operating parts of equipment
10. Acoustical materials (including acoustical decking)
11. Concealed pipes, ducts and conduits

H. Furnish all materials, labor, services, tools and incidentals necessary for completion of painting of exposed interior and exterior surfaces and other items as scheduled.

I. Work of this section is in addition to shop priming and surface treatments included elsewhere.

K. Standard paint coating terms as defined in ASTM D16 shall apply to this section.

L. Paint and/or finish the entire work, whether every item is herein specified or not. Where a specific item is not mentioned but requires painting or finishing, it shall be painted or finished to the specifications of similar or adjacent work. Do not paint surfaces or materials where specifications indicate surface to remain natural.

M. Includes examination of plans, finish schedules, the specifications for other divisions, and thorough familiarization with all provisions regarding painting of items left unfinished by other divisions that shall be painted to completion. If necessary, move scaffold to permit installation of other work without additional expense to the owner.

1.02 NOT USED

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM) D 16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.

B. Steel Structures Painting Council (SSPC) SP6 - Commercial Blast Cleaning Procedures.

C. Steel Structures Painting Council (SSPC) SP10 - Near White Blast Cleaning Procedure.

1.04 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16.

B. All paint shall comply to the following gloss and sheen standards

1. Gloss Level 1 (Traditional matte finish − flat): Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D523.

2. Gloss Level 2 (high side sheen flat - 'a velvet-like' finish): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

3. Gloss Level 3 (traditional 'eggshell-like' finish): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D523.

4. Gloss Level 4 ('satin-like' finish): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D523.

5. Gloss Level 5 (traditional semi-gloss finish): 35 to 70 units at 60 degrees, according to ASTM D523.

6. Gloss Level 6 (traditional gloss finish): 70 to 85 units at 60 degrees, according to ASTM D523.

7. Gloss Level 7 (high gloss finish): More than 85 units at 60 degrees, according to ASTM D523.

C. Environments: The following terms distinguish between different corrosive exposures:

1. "Severe environments" are highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation and with frequent cleaning using strong chemicals. Environments with heavy concentrations of strong chemical fumes and frequent splashing and spilling of harsh chemical products are severe environments.

2. "Moderate environments" are corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, and regular cleaning with strong chemicals. Environments with exposure to heavy concentrations of chemical fumes and occasional splashing and spilling of chemical products are moderate environments.

3. "Mild environments" are industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, and infrequent cleaning with strong chemicals. Environments with low levels of mild chemical fumes and occasional splashing and spilling of chemical products are mild environments. Normal outdoor weathering is also considered a mild environment.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Lead Renovation, Repair and Painting Rule (RRP Rule)

1. The EPA Lead Renovation, Repair and Painting Rule shall apply under this contract if facility being renovated under the scope of this project houses pre-school or kindergarten students and was constructed before 1978.

2. Any firm performing renovation, repair and painting that disturbs lead-based paint in the above type facility shall have their firm certified by EPA (or an EPA authorized state) as a Lead-Safe Certified Renovation Firm, use certified renovators trained by EPA approved training providers and follow lead-safe work practices.

Refer to the following websites for more information:

http://www2.epa.gov/lead/epa-lead-safe-certification-program

http://www2.epa.gov/lead/renovation-repair-and-painting-program

C. Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

D. Paint exposed surfaces. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will select from standard colors and finishes available.

E. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

F. All Painting Materials: Deliver to site in manufacturer's sealed containers. Each container shall be labeled by the manufacturer including company name, brand, type of paint, color, and instruction for reducing.

G. All materials applied to same surface from the primers through finish coats shall be by the same manufacturer.

H. Materials of any manufacturer will not be allowed on the project site at any time during construction except those of the manufacturer specified or approved by the architect.

I. Materials shall be mixed in and applied directly from containers in which they are purchased except when use of other containers is approved by the architect.

J. Turpentine, mineral spirits, linseed oil, and thinners shall be used only as recommended by the manufacturer of the specified paint material herein specified.

1.06 SUBMITTALS, SCHEDULES AND SAMPLES

A. Submit a manufacturer's authorized representative "Schedule for Materials" for approval within thirty (30) days after the contract date, giving the manufacturer and specifications as to type of each material intended for use on the work. Provide manufacturer's letter certifying that the total list of materials are "first-line products" and that proposed application methods at respective surfaces are in accordance with manufacturer's recommended application. Do not start any work until all materials are approved as conforming to specifications.

B. Sustainable Design Submittals:
1. Product Data: For paints and coatings, indicating VOC content.
2. Environmental Product Declaration (EPD): For each product.
3. Health Product Declaration (HPD): For each product.
4. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
5. Environmental Product Declaration (EPD): For each product
6. Third-Party Certifications: For each product
7. Third-Party Certified Life-Cycle Assessment: For each product
8. Manufacturer Inventory: For each product, provide manufacturer's manifest of ingredients.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Matching Existing Paint Colors

1. When the drawings call for paint to match existing in the case of renovation projects - the colors shall be selected by the following methods:

a. District/owner and/or maintenance staff to provide architect with a list of paint colors already utilized throughout the building or campus. Warehouse inventory may aid in making the selection.

b. Contractor to field verify colors by using a scanning color matching device. Example: Color Muse http://colormuse.io/ , download app and use with smartphone. Contractor to provide list to architect for records.

c. Architect to select colors.

E. Coating Maintenance Manual: Upon conclusion of the project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as "Sherwin Williams "Custodian Project Color and Product Information" report or equal.

1. Manual shall include an Area Summary with finish schedule, Area detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch up procedures, and color samples of each color and finish used.

F. The architect will issue a color schedule showing the various colors and their locations before samples are made.

G. Prepare samples of finishes on the job for review by owner and architect. Provide “layered” or “stepped” samples defining each separate coat, including all fillers and primers. Use colors represented in color schedule. Resubmit until required sheen, texture and color are accepted. List all materials used on each sample and label for location to be used.

H. If required, apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made to demonstrate aesthetic effects and set quality standards for materials and execution. A small portion of wall surface, 4’ x 8’, shall be finished as final sample. Submit one sample 12” x 12” of each type natural or stained finished on specified wood. Approval of mockups does not constitute approval of deviations from the Contract Documents continued in mockups unless specifically approved such

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver all products to the site in manufacturer’s original, unopened containers bearing manufacturer’s label with the following information:

Product name of material
Product description
Manufacturer’s item number and date of manufacture
Content by volume, for pigment and vehicle components
Application and thinning instructions
Color name and number
VOC Content

B. Store any materials not used in tightly covered containers in a well-ventilated area at temperature not less than 45 degrees or more than 95 degrees F.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).

C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).

D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

E. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.09 ATTICK STOCK

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Quantity: Furnish Owner with an additional five percent, but not less than 2 gallon, of each material and color applied.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The first line product of the following manufacturers shall be acceptable for use throughout the project:
1. PPG Paints
2. Benjamin Moore & Co.
3. Sherwin Williams
4. Requests for substitutions will be considered in accordance with provisions of Section 01 25 13.

B. Material Compatibility : Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

C. Provide manufacturer's best quality paint materials for the coatings specified and that are recommended by the manufacturer for the application indicated. Painting material containers which do not display the original manufacturer's identification labels are not acceptable.

D. VOC Classification: Provide high-performance coating materials, including primers, undercoats, and finish-coat materials, that have a VOC classification as noted in paragraph 1.01 above.

E. Substitution submittal shall list the specified location and paint product number along with the proposed substitute paint product type and number or name. Refer to Supplementary General Conditions and Division 1 regarding substitutions.

F. Manufacturer shall have paint outlet that is staffed during normal 8:00 a.m. to 5:00 p.m., Monday through Friday work week with full line of stocked paints and with full match and mix capabilities for custom colors.

G. Provide paint colors as indicated in the finish schedule supplied by the Architect. Refer to paint schedule at the end of the specification.

H. Colors: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.01 EXAMINATION / CONDITION OF SURFACES

A. Examine all surfaces to receive painting before beginning work and correct defects that could affect quality of finished work. Prepare surfaces to receive painting as specified. Re-touch shop coats and prime coats if damaged before proceeding. For remodel work where painting of existing, previously painted/finished/coated surfaces is required, properly remove existing finish and prepare surface for new paint finish as indicated.

B. Inspection of Surfaces: Do not begin work on any surface until inspected and in proper condition to receive paint specified. If the surface to be finished cannot be put in proper condition for finishing by customary preparation methods, the painting contractor shall notify the general contractor and architect, in writing, or thereby assume responsibility for and correct any unsatisfactory finish resulting.

C. Starting of painting work shall be construed as evidence of acceptance of surfaces and conditions under which work will be done.

3.02 PREPARATION AND WORK PROTECTION

A. Remove hardware, accessories and other items not scheduled to be painted. Provide appropriate edge and surface protection for items which are not practical for removal. After completion of work in each area, reinstall items removed using workers skilled in the trades involved.

B. Drop cloths shall be laid in all areas where painting to protect floors and other work from paint damage. Protect all existing materials and furnishings.

C. Materials shall be stored in a satisfactory manner or where directed. Oily rags and waste must be removed from the building every night and under no circumstances shall they be allowed to accumulate.

D. Painting Contractor shall be responsible for any damage done to the work of others caused by executing the work herein. Replace or repair, at own expense, materials damaged to such an extent that they cannot be restored to “as new” condition.

3.03 PREPARATION OF SURFACES - GENERAL

A. General Preparation: All surfaces to be finished shall be physically tight, in first class condition as to profiles, joints, etc. Rough matter, rough spots, prime coat paint runs, etc., shall be removed.

B. All surfaces must be absolutely smooth and free of dirt, rust, grease, rough spots, etc.

C. Proper preparations of all surfaces will be strictly enforced and whenever the finished surfaces show defects due to improper workmanship, defects shall be removed and work refinished at no additional cost to the Owner.

D. Before painting, remove hardware, accessories, plates, lighting fixtures, and similar items. On completion of each space, replace above items. Use only skilled mechanics for such work. When spray painting, protect adjacent surfaces as required or directed.

E. Caulking shall be uniformly and properly applied.

3.04 PREPARATION AND CLEANING OF SURFACES – CONCRETE/CMU/MASONRY/STUCCO

A. All work shall be allowed to dry completely (usually 60 to 90 days before painting).

B. Thoroughly clean and properly prepare all CIP concrete, concrete masonry (CMU), and cement plaster surfaces to be painted. Remove any dust, efflorescence, dirt, chalk, grease & oils and any release agents. Roughen any glazed surfaces or use mechanical methods to properly prepare surfaces.

C. Do not paint surfaces if moisture content or alkalinity exceeds that permitted in the coating manufacturer's written instructions.

D. If concrete floors are scheduled to be painted or sealed, clean with 5 percent solution of muratic acid or other etching cleaner. Flush floor with water to remove acid, neutralize with ammonia, thoroughly rinse again and allow to dry before painting or sealing.

E. Remove concrete stains resulting from weather, oil or corroded metals as follows:

Rust: If the stain is light or shallow, mop the surface with a solution of 1 lb oxalic acid per gal of water. Wait two or three hours, and then scrub the surface with stiff brushes while rinsing with clear water. If the stain is deep, use a poultice. Mix 11 oz (by weight) sodium citrate and 2 qt lukewarm water. Add 2 qt 12 oz glycerol. Make a stiff poultice with diatomaceous earth or talc; trowel over the stain. Leave the poultice for 2 or 3 days. Repeat if necessary.

Oil: If the oil is freshly spilled, soak it up with absorbent paper; do not wipe it up. Cover the stain with a dry powdered material such as portland cement, hydrated lime, cornmeal, or cat litter. Wait approximately 24 hours, then sweep it up. Scrub the remaining stain with scouring powder or a strong soap solution. If the stain is old, cover it with flannel soaked in a solution of equal parts acetone and amyl acetate. Cover the flannel with a pane of glass or a thin concrete slab for 10 to 15 min. Repeat if necessary. Rinse when the cleaning process is complete.

F. Painting subcontractor shall notify contractor to remove all mortar daubs, eliminate pinholes, remove chipped or otherwise unacceptable C.M.U. before start of block filler work.

G. When surface preparation is complete, including complete coverage of block filler, notify Architect for review prior to application of finish coats.

3.05 PREPARATION AND CLEANING OF SURFACES – FERROUS METALS

A. Clean surfaces shop-painted ferrous metals free of concrete, mortar, plaster, rust, shavings, dirt, dust and other objectionable materials. Use solvents or mechanical cleaning methods complying with SSPC- level SP-3: Power Tool Cleaning, SP-1 Solvent Cleaning, SP-2 Hand Tool Cleaning, SSPC-SP7/ NACE No.4, SSPC-SP 11.

B. Touch-up shop applied primer and any bare areas which have been damaged.

C. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.06 PREPARATION AND CLEANING OF SURFACES – GALVANIZED METALS

A. Clean galvanized surfaces free of loose particles and other objectionable materials. Clean with non-petroleum based solvents so that surface is free of oil, dirt and other contaminants.

B. Coat welded, chipped or abraded surfaces with Galvalloy protective coating or ZRC Galvilite Zinc coating (1-800-831-3275) after wire brush cleaning.

C. Wipe surfaces to be painted with manufacturer's recommended surface conditioner for painting of galvanized surfaces.

3.07 PREPARATION AND CLEANING OF SURFACES – WOOD

A. Clean knots, pitch streaks or visible sap spots free of residue and treat with Knot Sealer. Apply second coat of sealer no less than two (2) hours after application of first coat.

B. Clean surfaces free of dirt, oil, grease and other objectionable substances with scrapers, mineral spirits and sandpaper.

C. Fill all nail holes and other indentations with compatible wood filler to match wood and sand smooth with No. 00 sandpaper. Remove all dust with tack rags prior to finishing.

D. Backprime all wood sheet products which contact masonry, plaster or other wet wall construction. Prime all edges, ends, faces, undersides, and backsides of wood.

E. Any wood not stained or painted shall be sealed with non-yellowing polyurethane or varnish. Cracks, screw holes and nail holes shall be filled with putty to match natural wood prior to final coats of finish.

F. Sandpaper all trim edges to ease edge before start of work.

G. Sand between each paint coat to produce an even, smooth finish free from scratches, brush marks, paint brush hairs, etc.

3.08 PREPARATION AND CLEANING OF SURFACES – GYPBOARD

A. Remove contamination from surfaces and properly prepare gypboard for texture coating as specified in gypboard section. After applying texture, finish painting as shown in schedule.

B. Apply MEDIUM texture (spray-on application) to all gypsum board (walls and ceilings). Provide either 12” x 12” sample of texture for approval by architect prior to application or if requested, provide actual wall sample of texture applied over taped and floated gypboard seam for review and approval.

3.09 APPLICATION

A. Exterior Surfaces: Do not paint while damp, during rainy or frosty weather, or when temperature is below 45°F, not while exposed to hot sun or above 90°F.

B. No interior painting or finishing shall be permitted until building has thoroughly dried out by natural or artificial heat.

C. Do not open containers until required for use. Thoroughly mix paint before application and frequently stir during application so as to maintain pigment satisfactorily in suspension.

D. DO NOT THIN PAINT in excess of the printed directions of the manufacturer..

E. Apply paint uniformly without visible laps, sags, curtains, holidays or objectionable brush marks. Exercise care so that paint does not splatter on surfaces not required to be painted. Promptly remove paint applied or splattered on surfaces not required to be painted.

F. All coats shall be thoroughly dry before applying succeeding coats; sand lightly between coats on all materials.

G. Apply coats of material in strict accordance with manufacturer's current published specification.

H. Spotting or covering of small areas will not be permitted unless covered by at least one (1) additional coverall coat.

I. Rooms shall be swept/vacuumed out before applying finish and no sweeping shall be done adjacent to such finish not yet dried dust free.

J. All "hot" or "flat" spots that may appear in the cement surfaces after the priming coat has been applied shall be "spotted in" with the same material before the second coat. "Hot" or "flat" spots showing after the finish coat has been applied shall be refinished as before.

K. The inside of all cases, cabinets, etc. shall be finished exactly as specified for the exterior face of same unless otherwise specified.

L. Doors: Before hanging, finish tops, bottoms, and edges same as faces after they have received final fitting to frame. Paint glass light frames in doors color to match door frame color.

M. All closets shall be finished the same as the adjoining room unless otherwise specified.

N. Paint factory finished access panels, registers, grilles, diffusers, electrical panel boxes, covers and similar items the same color as adjoining walls or ceilings. Use color as directed where adjacent surfaces do not require painting.

O. Where visible through registers or grills, paint interior surfaces of ducts with a flat black paint.

P. Block Filler: Apply block filler to masonry block at a rate and thickness to insure complete coverage and that NO PIN HOLES ARE VISIBLE.

Q. Mechanical items to be painted include:
uninsulated metal piping
uninsulated plastic piping
pipe hangers and supports
tanks without factory applied finish
duct, equipment and pipe insulation having "all service jacket" or other paintable jacket material
mechanical equipment that is indicated to have factory primed finish for field painting

3.10 WORKMANSHIP

A. Top quality, using skilled mechanics only.

B. Only the best workmanship is acceptable. All material shall be spread and smoothly flowed on without runs, streaks, sags, brush marks, unfinished patches or other blemishes.

C. Illumination: Provide adequate illumination. Poor illumination will be grounds for rejection of work. Minimum of 20-foot candles for all surfaces.

3.11 REVIEW OF WORK / QUALITY CONTROL

A. Each coat must be reviewed and approved by the General Contractor before application of the succeeding specified coat. If not reviewed by the General Contractor, no credit will be given for the coat applied and the General Contractor automatically assumes the responsibility to recoat the work in question.

B. Tint each undercoat a lighter shade to facilitate identification of each coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. Should question arise over the number of coats applied to an area or space which was not inspected as stated above, the construction manager or architect may, at his option, require additional coats to be applied and the work shall be performed by this division without additional charge.

D. Any areas or surfaces not covered or showing variation of shades due to uneven application of materials shall receive additional coats to cured film until uniform paint finish, color, and appearance are corrected.

E. At completion of work, clean off all paint spots, oil and stains from floors, tile work, woodwork, glass, hardware, etc. leaving the building in perfect condition as far as this work is concerned.

F. Dry-Film Thickness (DFT) Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for DFT.

1. Contractor shall touch up and restore painted surfaces damaged by testing.

2. If test results show that DFT of applied paint does not comply with paint manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide DFT that complies with paint manufacturer's written instructions.

3. Owner may direct Contractor to stop painting if test results show material being used does not comply with the specified requirements. If necessary, Contractor may be required to remove no-complying paint from the painted surfaces if material is tested and shown to not be in compliance with the specifications.

3.12 CLEAN UP

A. Cleaning: At completion of paint work, the contractor shall remove from the premises all excess material, paint cans, drop cloths, and other materials used in this work. This contractor shall remove from other work all paint droppings or dirt caused by this work.

1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.

2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.

3. Allow empty paint cans to dry before disposal.

4. Collect waste paint by type and deliver to recycling or collection facility.

3.13 PAINTING SCHEDULE *(NOT ALL ITEMS LISTED BELOW MAY BE IN THE PROJECT. REFER TO THE DRAWINGS FOR LOCATION AND EXTENT OF ITEMS TO BE PAINTED.)*

EXTERIOR

A. CONCRETE MASONRY UNIT BLOCK FILLERS/PRIMER

1. Benjamin Moore & Co.: Ultra Spec Hi-Build Masonry Block Filler 571
2. PPG Paints: Speedhide Latex Hi Fill Block Filler No. 6-15XI. Applied at a DFT 8.0 mils.
3. Sherwin Williams: S-W PrepRite Interior/Exterior Latex Block Filler B25W25 (One Coat at16 mils wet; 7.7 mils dry)

B. CMU LATEX Finish Coat(s):

1. Benjamin Moore: Provide product recommended by manufacturer.
2. PPG Paints: Speedhide Exterior 100% Acrylic Latex Satin 6-2045XI Series. Applied at a DFT of 1.3 mils.
3. Sherwin-Williams: A-100 Exterior Latex, Satin, A82-Series (Two Coats @ 4 mils wet;1.4 mils dry)

C. CONCRETE MASONRY UNIT (CMU) BLOCK FILLER/PRIMER – SURFACE SEALER

Prime Coat:

1. Benjamin Moore & Co.: Ultra Spec Acrylic Sealer 608. Applied at a DFT of 0.95 mils.
2. PPG Paints: Perma-Crete 4-808 Series Acrylic Masonry Sealer. Applied at a DFT of 0.7 – 1.4 mils.
3. Sherwin Williams: Loxon Conditioner A24W01100. Applied at a DFT of **X** mils.

D. CMU FINISH TOPCOAT(S) – ELASTOMERIC:

Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Manufacturer's recommended product.
2. PPG Paints: Perma-Crete Pitt-Flex Elastomeric 4-110XI. Applied at a DFT of 5.4 - 7.2 mils.
3. Sherwin-Williams: Loxon XP, Satin, LX21-50 Series (One to Two Coats over Block Filler @ Wet mils: 17-21.5, Dry mils: 6.5-8.2)

E. CONCRETE/MASONRY/STUCCO PRIMER:

Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Manufacturer's recommended product.
2. PPG Paints: Perma-Crete 4-603XI Alkali Resistant Primer (Applied at a DFT of 1.4-2.6 mils).
3. Sherwin-Williams: Loxon Concrete Masonry Primer Sealer, LX02W0050 (One Coat at 5.3-8.0 Wet Mil Thickness, 2.1-3.2 Dry Mil Thickness)

F. CONCRETE/MASONRY/STUCCO FINISH COATS:

Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Super Spec Exterior Latex Satin 184. Applied at a DFT of 1.0 mils.
2. PPG Paints: Speedhide Exterior Latex Satin 6-2045XI. Applied at a DFT of 1.3 mils.
3. Sherwin-Williams: A-100 Exterior Latex, Satin, A82-Series (Two Coats @ 4 mils wet;1.4 mils dry)

G. **EXTERIOR ACRYLIC ENAMEL** (For exterior concrete, masonry, wood where semi-gloss or gloss finish is required):
Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Ultra Spec HP Acrylic DTM Gloss Enamel HP28
2. PPG Paints: Pitt-Tech Plus Acrylic Gloss DTM Industrial Enamel 90-1310. Applied at a DFT of 2.0-4.0 mils.
3. Sherwin Williams: S-W Pro Industrial Acrylic, Semi-Gloss or Gloss, B66 Series (Two finish coats over appropriate primer @ Wet mils: 6.0-12.0, Dry mils: 2.2-4.4)

H. **EXTERIOR FERROUS (NOT GALVANIZED) METAL PRIMER**
Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
2. PPG Paints: Pitt-Tech Plus Primer 4020PF. Applied at a DFT of 2.2-3.5 mils.
3. Sherwin Williams: Pro-Cryl Universal Water Based Primer B66-1300 (1 Coat at 5.0-10.0 wet mils, 1.9-3.8 Dry Mil Thickness)

I. **EXTERIOR GALVANIZED METAL PRIMER**
Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
2. PPG Paints: Pitt-Tech Plus Primer 4020PF. Applied at a DFT of 2.2-3.5 mils.
3. Sherwin Williams: Pro-Cryl Universal Water Based Primer B66-1300 (1 Coat at 5.0-10.0 wet mils, 1.9-3.8 Dry Mil Thickness)

J. **EXTERIOR GALVANIZED TOUCH-UP FOR UNPAINTED GALVANIZED SURFACES**

1. ZRC Worldwide Galvalite #10,000 Touch up primer (Availability call 1-800-831-3275)

K. **EXTERIOR METAL FINISH PAINT EXTERIOR ENAMEL** (For all exposed Steel, Exterior and Interior Hollow metal doors & frames)
Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Super Spec Urethane Alkyd Gloss P22
2. PPG Paints: HPC Urethane Alkyd Enamel Semi-Gloss 4336H. Applied at a DFT of 2.0-2.5 mils.
3. Sherwin Williams: S-W Pro Industrial Waterbased Urethane Alkyd, Semi-Gloss, B53 Series (Two Coats over appropriate Primer @ Wet mils: 4.0-5.0, Dry mils: 1.4-1.7)

L. EXTERIOR PAVEMENT MARKINGS

1. Alkyd/Solvent Based, Fast Drying Pavement Marking Paint:
   a. Benjamin Moore: Manufacturer's recommended product
   b. PPG Paints: Zoneline Exterior Acrylic Traffic Paint 11-53 Series. Applied at a DFT 8.7 mils.
   c. Sherwin-Williams: Setfast® Acrylic Solvent borne Traffic Marking Paint, TM562 Series (Apply one coat @ Wet mils: 15.0/Dry mils: 8.7- open to heavy traffic in 5 min)

   (Provide "White" color for line work, "Blue" color for handicapped marking, and "Red" for fire lanes, unless otherwise indicated.)

2. Latex Water-Base Emulsion Type Pavement Marking Paint (Best Color Retention):
   a. Benjamin Moore: Manufacturer's recommended product
   b. PPG Paint: Zoneline Exterior Acrylic Traffic Paint 11-53 Series. Applied at a DFT 8.7 mils.
   c. Sherwin-Williams: Pro-Park™ Waterborne Traffic Marking Paint, B97 Series (Apply one coat @ Wet mils: 15.0/Dry mils: 7.5, open to heavy traffic in 120 min)

   (Provide "White" color for line work, "Blue" color for handicapped marking, and "Red" for fire lanes, unless otherwise indicated. Provide white stenciled "No Parking - Fire Lane" marking complying with requirements of authorities having jurisdiction.)

3. Playground Markings and areas larger then typical line stripes:
   a. Benjamin Moore: Manufacturer's recommended product
   b. PPG: Manufacturer's recommended product
   c. Sherwin-Williams: S-W H&C Colortop Waterbased Solid Color Concrete Stain (available in almost any color)(Apply a minimum of two coats – coverage will vary with substrate porosity): Add Shark Grip anti-skid packages to coating for additional slip resistance.

4. Preparation: Confirm that asphalt and concrete paving has cured a minimum of 30 days and that pavement surfaces are dry before starting pavement marking. Sweep and clean surface to remove loose material, dust and debris. Carefully and accurately lay out the location and termination of traffic and lane markings at the locations indicated.

5. Application: Apply paint with airless spray equipment with wing to limit overspray. Produce pavement markings of 4" uniform width, with straight edges and accurately aligned with layout lines. Apply paint at the rate of 15 mils wet film thickness (100 to 150 sq. ft./gal.) in accordance with manufacturer's printed instructions.

6. Curing and Protection: Barricade pavement areas to prevent traffic until coatings are completely cured and ready to receive traffic in accordance with coating manufactures printed instructions and recommendations.

7. Monitor wet weather conditions prior to applying paint so curing process is not affected. Refer to manufacturer's recommendations.

INTERIOR

M. **INTERIOR CONCRETE & MASONRY PRIMER**
Prime Coat

1.	Benjamin Moore:	Ultra Spec Int/Ext High Build Masonry Primer 609 or Ultra Spec 100% Acrylic Sealer 608
2.	PPG Paints:	4-603XI Perma-Crete® Alkali Resistant Primer. Applied at a DFT of 1.4-2.6 mils.
3.	Sherwin Williams:	Loxon Masonry Primer LX02W0050 (One Coat at 5.3-8.0 Wet Mil Thickness, 2.1-3.2 Dry Mil Thickness)

N. **INTERIOR GLAZED BRICK ETCH AND PRIMER:** Factory Formulated Water-Based etch and primer for interior application.

1. PPG Paints: X-I-M Etch-I-M; Etching Cream #4408, Water-Based, Brush-able Acid Etch.
   a. PPG Paints: X-I-M Uma, XIM-04 Advanced Technology Primer Sealer Bonder (tint base), Water-Based bonding agent.

O. **HIGH PERFORMANCE (EPOXY) CONCRETE MASONRY UNIT BLOCK FILLERS** (To be used on CMU in all KITCHENS, RESTROOMS, DRESSING ROOMS, ETC. and high moisture or high humidity areas)
Prime Coat

1.	Benjamin Moore & Co.:	Corotech Waterborne Epoxy Block Filler V163
2.	PPG Paints:	Amerlock 400 BF Epoxy Block Filler. Applied at a DFT of 10.0-20.0 mils.
3.	Sherwin Williams:	Kem Cati-Coat HS Epoxy Filler/Sealer or Epo-Plex Cementitious Waterbased Epoxy Block Filler #B71-300 Series (One to two coats as needed to fill voids and create a continuous substrate. It is rare that two coats would be needed. Wet mils14.0 - 28.0, Dry mils 10.0 - 20.0)

P. **INTERIOR CATALYZED WATER BORNE EPOXY** (Eg-Shel or Semi-Gloss Finish– To be used as the Finish Coats in all painted surfaces in Kitchens, Restrooms, Showers Rooms and other high moisture, high abrasion or chemical areas)
Intermediate Coat and Top Coat (2 coats)

1.	Benjamin Moore:	Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341
2.	PPG Paints:	Aquapon WB EP Waterborne Epoxy Semi-Gloss 98E-1/98E-100 Series. Applied at a DFT of 2.0-4.0 mils.
3.	Sherwin Williams:	Pro Industrial Water Based Catalyzed Epoxy B73-300 Series, Eg-Shel Hardner (Two Coats @ Wet mils: 5.0-12.0 Dry mils: 2.0-4.9)

Q. **INTERIOR GLOSS WATER BORNE ACRYLIC EPOXY Gloss Finish**

(To be used as the Finish Coats in all painted surfaces in Kitchens, Restrooms, Showers Rooms and other high moisture, high abrasion or chemical areas)
Intermediate Coat and Top Coat (2 coats)

1.	Benjamin Moore:	Super Spec HP Waterborne Polyamide Epoxy Gloss Coating #M42/M 42-84 or Moorecraft Super Spec Acrylic Epoxy #256 Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341
2.	PPG Paints:	Aquapon WB EP Waterborne Epoxy Gloss 98E-1/98E-98 Series. Applied at a DFT of 2.0-4.9 mils.
3.	Sherwin Williams:	Pro Industrial Water Based Epoxy B73W-300, Gloss Hardner (Two Coats @ Wet mils: 5.0-12.0 Dry mils: 2.0-4.9)

R. **INTERIOR FERROUS METAL PRIMER**
Intermediate Coat and Top Coat (2 coats)

1.	Benjamin Moore:	Ultra Spec HP Acrylic Metal Primer HP04
2.	PPG Paints:	Pitt-Tech Plus Primer 4020 PF. Applied at a DFT of 2.2-3.5 mils.
3.	Sherwin Williams:	Pro-Cryl Universal Metal Primer B66-1300 (1 Coat at 5.0-10.0 wet mils, 1.9-3.8 Dry Mil Thickness)

S. **INTERIOR GALVANIZED / ZINC COATED METAL PRIMER**
Prime Coat

1.	Benjamin Moore:	Ultra Spec HP04 Acrylic Metal Primer
2.	PPG Paints:	Pitt-Tech Plus Primer 4020 PF. Applied at a DFT of 2.2-3.5 mils.
3.	Sherwin Williams:	Pro-Cryl Universal Metal Primer B66-1300 (1 Coat at 5.0-10.0 wet mils, 1.9-3.8 Dry Mil Thickness)

T. **INTERIOR WOOD PRIMER**
Prime Coat

1.	Benjamin Moore:	Fresh Start Multi Purpose Latex Primer N023
2.	PPG Paints:	SEAL GRIP® Universal Primer/Sealer 17-921XI. Applied at a DFT of 1.6 mils.
3.	Sherwin Williams:	S-W Premium Wall & Wood Primer, B28W8111 (One Coat @ 4.0 mils wet, 1.6 mils dry)

U. **INTERIOR DRYFALL** (For exposed steel roof structure, roof deck, mechanical ductwork, piping and

conduit. Do not paint acoustical decking)
Top Coat (1 coat)

1. Benjamin Moore: Benjamin Moore Latex Dryfall Flat 395
2. PPG Paints: Speedhide Super Tech WB Interior Flat Dry Fog, 6-725XI Series Applied at a DFT of 2.4
3. Sherwin Williams: S-W Pro Industrial Waterborne Acrylic Dryfall, B42 series (One Coat @ Wet mils: 6.0-9.0, Dry mils: 1.5-2.3)

V. INTERIOR GYPBOARD PRIMER
Prime Coat

1. Benjamin Moore: Ultra Spec 500 Interior Acrylic Primer 534
2. PPG Paints: Speedhide Zero Primer, 6-4900XI. Applied at a DFT of 1.4 mils.
3. Sherwin Williams: ProMar 200 Zero VOC Interior Latex Primer, B28W2600 (Apply one coat @ 4 mils wet; 1.0 mils dry)

W. GYPBOARD FINISH, LOW VOV, EGG SHELL (Gloss Level 3)
Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Ultra Spec 500 Interior Acrylic Eggshell 537
2. PPG Paints: Speedhide Zero VOC 6-5310. Applied at a DFT of 1.5 mils.
3. Sherwin Williams: ProMar 200 Zero VOC Latex Eg-shel, B31 Series (Apply two coats @ 4 mils wet, 1.7 mils dry)

X. GYPBOARD FINISH, LOW VOC, SEMI-GLOSS, (Gloss Level 5)
Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Ultra Spec 500 Interior Acrylic Semi-Gloss 539
2. PPG Paints: Speedhide Zero VOC 6-5510 Interior. Applied at a DFT of 1.3 mils.
3. Sherwin Williams: ProMar 200 Zero VOC Latex Semi-Gloss, B31 Series (Apply two coats @ 4 mils wet, 1.7 mils dry)

Y. GYPBOARD FINISH, LOW VOC, GLOSS, (GLOSS LEVEL 6)
Intermediate Coat and Top Coat (2 Coats)

1. Benjamin Moore: Ultra Spec 500 Interior Acrylic Gloss 540
2. PPG Paints: SpeedHide® Interior 6-8534. Applied at a DFT of 1.2 mils.
3. Sherwin-Williams: ProMar 200 Zero Voc Latex Gloss, B31 Series (Apply two coats @ 4 mils wet, 1.7 mils dry)

Z. INTERIOR WOOD STAINS AND VARNISHES

1. **OPEN GRAIN WOOD FILLER**

   a. Benjamin Moore: Manufacturer's recommended product

   b. PPG Paints: Manufacturer's recommended product

   c. Sherwin Williams: S-W Minwax Stainable Woodfiller

2. **INTERIOR WOOD STAIN (Two Coats to Achieve Color)**

   a. Benjamin Moore: Lenmar Interior WB Wiping Stain 1WB.1300 Series

   b. PPG Paints: Deft Interior Water Based Wood Stain, DFT300.

   c. Sherwin Williams: S-W Minwax Performance Series Tiltable stain

3. **CLEAR SANDING SEALER**

   a. Benjamin Moore: Manufacturer's recommended product

   b. PPG Paints: Deft Interior Wood WB Sanding Sealer, DFT61. Applied to a DFT of 0.8 – 1.1 mils.

   c. Sherwin Williams: S-W Minwax Performance Series Fast-Drying Sanding Sealer (One coat @ 4 mils wet; 1.0-1.3 mils dry followed by top coat)

AA. INTERIOR ALKYD OR POLYURETHANE BASED CLEAR SATIN VARNISH
Topcoat (2-3 coats)

1. Benjamin Moore: Lenmar Aqua-Plastic® Waterborne Urethane 1WB.14XX Series

2. PPG Paints: Deft Interior Oil Based Satin Polyurethane, DFT129. Applied at a DFT of 1.5 mils.

3. Sherwin Williams: S-W Minwax Fast Drying Polyurethane, Satin

BB. INTERIOR SATIN ACRYLIC POLYURETHANE
Topcoat (2-3 coats)

1. Benjamin Moore: Lenmar Aqua-Plastic® Waterborne Urethane Satin 1WB.1427

2. PPG Paints: Deft Interior Acrylic Polyurethane Satin, DFT159. Applied at a DFT of 0.8 mils.

3. Sherwin Williams: S-W Minwax Polycrylic Protective Finish, Satin applied at a DFT 0.6 dry mil per coat

CC. INTERIOR GLOSS ACRYLIC POLYURETHANE

Topcoat (2-3 coats)

1. Benjamin Moore: Lenmar Aqua-Plastic® Waterborne Urethane Gloss 1WB.1400

2. PPG Paints: Deft Interior Acrylic Polyurethane Gloss, DFT157. Applied at a DFT of 0.8 mils.

3. Sherwin Williams: S-W Minwax Polycrylic Protective Finish, Gloss applied at a DFT 0.6 dry mil per coat

DD. INTERIOR CONCRETE FLOOR COATINGS (Refer to Paragraph 3.04 for required surface prep)

1. **INTERIOR CONCRETE FLOOR COATING (EPOXY PRIMER AND FINISH)**
Prime Coat and Topcoat (2 coats)
   a. Benjamin Moore: Corotech 100% Solids Epoxy Floor Coating V430

   b. PPG Paints: Aquapon Waterborne Epoxy WB EP, 98E Series. Applied at a DFT of 2.0 – 4.0 mils.

   c. Sherwin Williams: (Self Priming) Two Coats ArmorSeal 8100 Water Based Epoxy Floor Coating. Follow manufacturers directions for proper floor preparation. (Apply at Wet mils 5.0-12.0, Dry mils 2.0- 5.0)

2. **INTERIOR CONCRETE SEALER**
   a. Ardex: CG Concrete Guard as manufactured by ARDEX Engineered Cements, 400 Ardex Park Drive, Aliquippa, PA 15001. Install in accordance with manufacturer's recommendations. www.ardex.com OR

   b. L & M Construction Chemicals: Permaguard SPS as manufactured by L & M Construction Chemicals, Inc. Install in accordance with manufacturer's recommendations. www.lmcc.com OR

   c. V-Seal: Industra-Seal 117A or Industra-Gloss WB sealer as manufactured by V-Seal Concrete Sealers & Specialty Coatings www.vseal.com OR

   d. Kemiko: Stone Tone Sealer II as manufactured by Kemiko Concrete Products, Leonard TX. Install in accordance with manufacturer's recommendations. www.kemiko.com. OR

   e. PPG Paints: Perma Crete Plex-Seal 4-6200XI Clear Concrete Sealer. Applied at a DFT of 0.8 – 1.3 mils. OR

   f. Sherwin-Williams: H & C Concrete Sealer Wet Look, Water Based Coating (Apply two coats, coverage may vary)

EE. INTERIOR HARDBOARD/STAGE FLOORING PAINT

Intermediate Coat and Topcoat (2 coats)

a. Benjamin Moore: Manufacturer's recommendation

b. PPG Paints: Break-Through! 50 Satin Wrought Iron Black V52-90. Applied at a DFT of 1.4 mils.

c. Sherwin-Williams: Armorseal Tredplex, B90 Series, black, Semi-Gloss Finish (Two Coats @ 3.5 -4.5 Wet Mils, Dry mils 1.5 - 2.0)

FF. INTERIOR GREEN SCREEN PAINT

1. Primer
a. PPG Paints: Seal Grip Universal Primer 17-921XI. Applied at a DFT of 1.6 mils.

2. Intermediate Coat and Topcoat (1 coat)
a. PPG Paints: Director's Choice Chroma Key Green PSL11070/EA High Hide Zero VOC High Luminance. Applied at a DFT of 1.5 mils.
b. Roscoe Paints: Chroma Key Paint 150 05711 0128 Matte Low VOC. Applied at a DFT of 2.0 mils.

GG. INTERIOR SHEEN REQUIREMENTS: Interior surfaces shall be painted in accordance with the following criteria over appropriate prime / sealer coat:

1. Walls: Eggshell – Gloss Level 3

2. Ceilings: Flat – Gloss Level 1

3. Laundry rooms: Semi-gloss - Gloss Level 5

4. Public washrooms / showers / change rooms / toilets:
   a. Dry Surfaces: Eggshell – Gloss Level 3
   b. Wet and Splash-Zone Surfaces: Semi-gloss – Gloss Level 5

5. Executive and Private washrooms / showers / change rooms / toilets:
   a. Dry Surfaces: Eggshell – Gloss Level 3
   b. Wet and Splash-Zone Surfaces: Semi-gloss – Gloss Level 5

6. Kitchens and Food-Prep Areas: Epoxy Gloss – Gloss Level 6

7. Institutional facility bathing and shower rooms: Epoxy Gloss – Gloss Level 6

8. Institutional facility "clean" or "sanitary" areas such as food preparation and laboratory areas: Gloss – Gloss Level 6

9. Metal surfaces (doors, frames, railings, structure, etc.): Semi-gloss – Gloss Level 5

10. Inside of Field Constructed Light Pockets and Valances: gloss – Gloss Level 6; white (unless noted otherwise)

END OF SECTION 09 90 00

SECTION 10 05 00 MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install all of the following equipment as shown on drawings and specified herein. Coordinate with other trades where such cooperation is indicated by furnishing installation requirements and details along with the material in adequate time for progress of the work. Furnish shop drawings.

B. All items shall be installed with anchors appropriate to the wall construction.

C. Securely install, plumb, level, square with surrounding area to height and location as directed by architect.

PART 2 - PRODUCTS

2.01 SPECIAL ITEMS

A. Overhead Barrier Free Lift System

1. Manufacturer: Mackworth
2. Product: TX600 Fixed Ceiling Lift
3. Description

a.	Max Safe Working Load:	600lb (272kg)
b.	Hoist Case:	Non Flammable ABS Plastic
c.	Length:	13.39" (340mm)
d.	Height:	5.75" (146mm)
e.	Weight (Hoist only):	22lb (10kg)
f.	Hosting Range:	Up to 78.74" (2000mm)
g.	Lifting Speed (unloaded):	2.54"/s (64.52mm/s)
h.	Lifting Speed (xxxlb loaded):	0.98"/s (25mm/s)
i.	Charger Input:	100-240V, AC-50/60Hz/1.5A
j.	Charger Output:	24VDC/1.0A
k.	Hand Control:	Pneumatic
l.	Batteries:	2 x 12 VDC 5.0 AH, Sealed Lead Acid
m.	In Track Charging:	Yes
n.	Removable from Track:	No
o.	Duty Cycle:	15% use, 85% rest

4. Substitutions: Refer to section 01 25 13

B. Electric Chain Hoist: Provide electrical receptacle near the hoist motor location

1. Basis of Design: Model 2GTD7 as manufactured by Dayton
2. Voltage: 120 V
3. Amps: 20
4. Phase: 1
5. Clutch: Overloading limiting
6. Thermal protection
7. Finish: Powder Coated
8. Color: Red
9. Load Capacity: 1,000 lb
10. Hoist Lift: 20 feet
11. Substitutions: Refer to section 01 25 13

PART 3 - NOT USED

END OF SECTION 10 05 00

SECTION 10 11 00 VISUAL DISPLAY BOARDS

PART 1 – GENERAL REQUIREMENTS

1.01 SUMMARY

A. Section includes: Porcelain enamel steel markerboards
Vinyl-fabric faced tackboards

B. Furnish and install porcelain enamel markerboards and vinyl fabric faced tackboards as shown on drawings and specified herein. Coordinate with other trades where such cooperation is indicated by furnishing installation requirements and details along with the material in adequate time for progress of the work.

C. All items shall be installed with anchors appropriate to the wall construction. Securely install, plumb, level, square with surrounding area to height and location as directed by architect.

1.02 SUBMITTALS

A. Provide product data for each type of visual display board specified.

B. SHOP DRAWINGS
1. Include dimensioned elevations and indicate location of joints between individual panels where unit dimensions exceed maximum panel length.

2. Include section details of all perimeter trim members.

3. Show all anchors, grounds, accessories, reinforcement, layout and installation details.

C. SAMPLES
1. Provide maunfacturer's color selection chart with ACTUAL SAMPLE swatches for each type of vinyl fabric faced tackboard indicated.

2. Provide ACTUAL SECTIONS of porcelain enamel finish for each type markerboard required. Sample to be not less than 6" x 6", mounted on the substrate indicated for final product. Include a panel for each type and color required. Provide samples of each finish type and color of aluminum trim and accessories (min. 6" long).

D. PRODUCT CERTIFICATE: Product Certificate: Provide certification from tackboard manufacturer that vinyl-fabric faced tackboard materials furnished comply with requirements for flame-spread ratings.

1.03. QUALITY ASSURANCE

A. Obtain all visual display boards through one source from a single manufacturer.

B. FIRE TEST RESPONSE REQUIREMENTS
1. Provide vinyl-fabric faced tackboards with the following surface burning characteristics as determined by testing assembled materials composed of facings and backings identical to those required in this Section per ASTM E 84 by a testing and inspecting agency acceptable to authorities having jurisdiction. Identify vinyl-fabric-faced tackboards with appropriate markings of applicable testing and inspecting agency.

Flame Spread: 25 or less
Smoke Developed: 10 or less

1.04. WARRANTY

A. General Warranty: The special porcelain enamel markerboard warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Porcelain Enamel Markerboard Warranty: Submit a written warranty executed by manufacturer agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking within the specitied warranty period, provided the manufacturers written instructions for handling, installation, protection, and maintenance have been followed.

C. Warranty Period: 50 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFAC URERS

A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:

1. Porcelain Enamel Markerboards:

Moore Co. (formerly Best-Rite Chalkboard Co.) www.moorecoinc.com
Claridge Products and Equipment, Inc., www.claridgeproducts.com
Lemco, Inc., www.adplemco.com
Newline Products. Inc., www.newlineproduct.com
Platinum Visual Systems, www.pvsusa.com
Polyvision, www.polyvision.com
Aarco Products, Inc. www.aarcoproducts.com
American Visual Display Products, LLC; www.americanvisualdisplay.com

2. Tackboards:

Moore Co. (formerly Best-Rite Chalkboard Co.) www.moorecoinc.com
Claridge Products and Equipment, Inc., www.claridgeproducts.com
Lemco, Inc., www.adplemco.com
Newline Products. Inc., www.newlineproducts.com
Platinum Visual Systems, www.pvsusa.com
Polyvision, www.polyvision.com
Aarco Products, Inc. www.aarcoproducts.com
American Visual Display Products, LLC; www.americanvisualdisplay.com

2.02 MATERIALS

B. Porcelain Enamel Markerboards: Balanced, high-pressure-laminated, porcelain enamel chalkboards of 3·ply construction consisting of face sheet, core material, and backing.

C. Face Sheet: 0.024-inch (min 24 gauge) enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat exposed face and edges with a 3-coat process consisting of primer, ground coat, and color cover coat. Coat concealed face with a 2-coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at manufacturers standard firing temperatures, but not less than 1200 deg F.

D. Cover Coat: For markerboards, provide manufacturers standard, light-colored, special writing surface with gloss finish intended for use with erasable dry markers.

E. Core: ½" thick, MDF core material complying with requirements of ANSI A208.1, Grade 1-M-1.

F. Backing Sheet: 0.015 inch- thick, alumlnum-sheet backing.

G. Laminating Adhesive: Manufacturers standard, moisture resistant, thermoplastic-type adhesive.

E. Music Staff Lines (at Band Hall, Orchestra, Choir Rehearsal, Ensemble 1, Ensemble 2): Provide manufacturers permanently fused music staff lines where indicated or directed; 5 lines each staff with 1" between each line; 5" between each staff and 3" boarder at top and bottom: Line thickness 1/16".

F. Ruled Lines for Science Classrooms: 6-foot wide board on teaching wall of each Science Lecture/Lab shall have 1/16" wide semi-transparent fused ruled lines, spaced at 1" on center each way.

H. Furnish and install tack board as shown on drawings. All tack boards shall be 4'-0" height x width as shown on drawings. Vinyl-Fabric-Faced Tackboards to be ½" thick, insulated wood fiberboard (Homosote) covered with vinyl fabric meeting the following minimum requirements:

1.	Total Weight	15 oz. PLY	10 oz. PSY
2.	Fabric Weight	1.8 oz. PSY	13.2 oz. PLY
3.	Roll Width	53/55"	
4.	Gauge	0.025" / 7 mils	
5.	Fabric Sheeting	Federal Spec CCC-W-408A, TYPE I CFFA Spec CFFA-W-101-D, TYPE I	
6.	UL Rating	(ASTM E-84 Tunnel Test)	
7.	Fire Testing	NFPA 101®, Life Safety Code® NFPA 255 (UL 723, CAN S102M) Tunnel Test* Class A Rating NFPA 286 Corner Burn Test** Meets requirements for flame spread, smoke developed and flashover. UL Listed and Labeled	

8. Vinyl covering shall meet or exceed all requirements of Federal Specifications CCC-W-408A Quality Standard for Vinyl Coated Fabric Wallcovering, CFFA-W-101A, and the Standard Classification of Wallcoverings by Durability Characteristics of ASTM-F-793-82 for the type and category classified including 24 hour cleanability tests based on ASTM method D1308.

9. Vinyl wallcovering shall be treated with an antimicrobial to resist the growth of mildew and bacteria including staphylococcus aureus, streptoverticillum reticulum (pink stain), and mixed fungal spore such as aspergillus niger, aspergillus flavus, penicillium funiculosum, and chaetomium globosum.

10. Provide color and texture as scheduled or as selected from manufacturers standards.

11. Provide factory edge trim, 6063 alloy grade aluminum with T5 tempering in accordance with ASTM B221, and shall have satin anodized finish.

12. Backing: Factory laminate cork face sheet under pressure to 3/8-inch thick fiberboard backing.

2.03 ACCESSORIES

A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062 inch thick, extruded-aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single length units. Keep joints to a minimum. Miter corners to a neat, hairline closure. Where tackboards are combined with markerboards, bottom trays and map rails shall be continuous across width of combination unit.

B. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturers standard structural support accessories to suit conditions indicated.

C. Bottom Tray: Manufacturers standard, continuous, box-type, aluminum tray with slanted front and cast-aluminum end closures for each markerboard.

D. Map Rail: Furnish map rail at top of each unit, complete with the following accessories:

1. Display Rail: Provide continuous cork display rail approximately 1 or 2 inches (25 or 50 mm) wide, as indicated, integral with map rail.

2. End Stops: Provide one end stop at each end of map rail.

3. Map Hooks: Provide 1 map hooks with flexible metal clips for every 12 inches of map rail or fraction thereof.

4. Flag Holder: Provide two flag holders for each room.

5. Refer to Section 10 05 00 for free-standing map rails (located in corridors)

2.04 FINISHES

A. General: Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products for recommendations relative to applying and designating finishes.

B. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.

C. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker complying with AAMA 607.1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine wall surfaces, with installer present, for compliance with requirements and other conditions affecting installation of visual display boards.

B. Surfaces to receive markerboards shall be free of dirt, scaling paint, and projections or

depressions that would affect smooth, finished surfaces of markerboards. Surfaces to receive tackboards shall be dry and free of substances that would impair the bond between tackboards and substrate. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Deliver factory-built visual display boards completely assembled in one piece without joints, where possible. If dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment. Install units in locations and at mounting heights indicated and according to manufacturers written instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

B. Coordinate Project-site assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

3.03 ADJUSTING AND CLEANING

A. Verify that accessories required for each unit have been properly installed and that operating units function properly.

B. Clean units according to manufacturers written instructions.

END OF SECTION 10 11 00

SECTION 10 14 00 ARCHITECTURAL SIGNAGE

PART 1 – GENERAL

1.01 SCOPE

A. Furnish and install the following:

1. Exterior wall mounted school name (building letters).
2. Building plaque.
3. Cast metal building letters
4. Room identification signage.
5. Occupancy signage for all assembly areas per IBC 1004.3
6. Traffic signage, including, but not limited to accessibility (Handicapped) parking signs.
7. Brackets, clips, posts, fasteners, concrete footings, and all accessories required for proper installation of signage.

1.02 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.

2. Manufacturer's installation instructions.

B. Shop Drawings:

1. Indicating materials, sizes, and finishes, indicate letter style, edge and corner treatment, details of fabrication and mounting installation, fasteners and hardware, attachments, related and adjacent work.
2. Electronic layout of actual pattern of cast metal plaque for Architect's approval prior to casting. Do not proceed with casting without architect’s review and approval.
3. Room signage (numbering and text) to be submitted in a separate submittal; allow for sixty (60) days of review for room signage so Architect can establish numbering/text with Owner.

C. Samples:

1. One (1) 6 inch by 6 inch sample of cast metal plaque material with specified finish.
2. One (1) 4 inch actual sample of cast metal letter in specified letter style and finish.
3. One (1) actual sample of each type room identification sign with specified finish.

1.03 QUALITY ASSURANCE

A. All signage and signage installation shall comply with latest edition of Americans with Disabilities Act (ADA) and Texas Accessibility Standards (TAS)

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Specifications are based on products and manufacturers listed as basis of specification or named. Products of manufacturers listed which meet or exceed the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

1. Approved Manufacturers:

a. A.R.K. Ramos Architectural Signage Systems, Oklahoma City, OK; www.arkramos.com
b. Best Manufacturing Sign Systems, Montrose, CO; www.bestsigns.com
c. Matthews Bronze Co., www.matthewsbronze.com
d. Gemini Incorporated, Cannon Falls, MN; www.geminiplaques.com
e. The Southwell Co., San Antonio, TX; www.southwellco.com
g. South Texas Graphic Specialties, Inc. , Houston
h. In-Pro Corporation; www.inprocorp.com
i. CCSW Architectural Graphics & Sign Systems, Corpus Christi, TX. www.ccswsignsystems.com

2.02 CAST METAL BUILDING LETTERS

A. Material and Fabrication:

1. Casting shall be of 319 aluminum alloy with satin polished faces and matte sides.
2. All letters shall be finished in clear anodized aluminum.
3. Letters at Street Signs (as detailed in 1/A1.5) shall be finished in baked enamel finish; color as selected by Architect.

B. Building Letters shall be Helvetica Medium style upper case letters, unless shown otherwise. Allow for thirty-five (70) 16” high letters at front entry canopy. Allow for seventy (70) 12” high letters, and seventy (70) 18” high letters to be used at roadway/entry signs.

C. Fasteners and Attachment Hardware: Concealed fasteners and hardware of size and type recommended by manufacturer for attachment of letters on brick or metal plate where indicated on drawings. Provide for channel/vertical attachment of letters at front entry.

D. Provide all materials required for a complete installation.

2.03 BUILDING PLAQUE

A. Furnish and install 18” x 24” aluminum plaque equal to that as manufactured by Southwell Company, San Antonio, Texas. Plaque shall contain no more than five hundred (500) letters and thirty (30) lines. Metal Arts, ASI, Mills Mfg. Company, and Sign International, Inc. are also approved manufacturers.

1) Cast virgin ingots, F-214 aluminum alloy. Casting shall be free of pits and gas holes and all letters shall be sharp and hand tooled.

2) Single line border; border and faces of raised letters are to be satin finish and plaque background to be leatherette texture. Background shall be sprayed with black acrylic lacquer. Plaque shall be chemically cleaned and etched and treated with alodine. Two coats of clear acrylic lacquer shall be sprayed on completed plaque.

3) Letter style shall be Helvetica.

4) Plaque shall be mounted on masonry wall with concealed fastening.

5) Architect will furnish plaque design and general layout. Contractor will furnish rubbing of actual pattern for owner's approval prior to casting.

2.04 ROOM IDENTIFICATION SIGNAGE

A. General:

1. Provide min. one (1) sign for every room; provide one (1) sign for each door at rooms that have multiple doors. Refer to Section 2.05 for rooms that are to have occupancy load signage provided. Provide ten (10) additional signs to be located as directed by architect. Exact room numbering / wording on signs to be provided by architect (after conferring with the Owner) during construction. Room Signage column on Door Schedules indicates Plaque type to be assigned to this door (see illustrations at the end of this section).

2. Constructed of one (1) or two (2) photopolymer colors bonded to an appropriate substrate, on both face-plate and back-plate; colors to be selected by Architect.

   a. Exterior room signs shall be constructed of exterior-grade aluminum photopolymer; interior signs to be constructed of interior-grade photopolymer bonded to thermoplastic polymer resin.
   b. Raised tactile grade 2 Braille shall be integral with the sign face and be raised 1/32". Glass or metallic rasters to have .059 surface diameters with body of sphere pressure secured below face laminate. Glued on dots will NOT be acceptable.
   c. Raised symbols shall be raised 1/32" from sign face and unitized with the acrylic sign core.
   d. All raised lettering shall be 5/8" high (min), raised 1/32" and be integral with the sign face; letter style to be sans serif style, (Helvetica, Optima, Futura, or Arial as selected by Architect - all upper case).
   e. All copy (lettering, numbering & symbols) shall have a contrast with their background and have an eggshell matte finish.
   f. Refer to drawings to determine which signs shall be rated for exterior conditions (based on the premise that signs are to be located on the "public" side of the door); confirm with Architect via submittal prior to fabrication.

3. Signage shall have radius corners with square-cut edges painted a color as selected by Architect.

4. Demarcation line, if any, shall be infilled to match copy color.

5. Signs shall comply with all state and federal codes, including, but not limited to the ADA and TAS requirements.

6. Refer to drawings at the end of this section for signage details for dimensions, types, colors, graphic layout; refer to drawings for sign type, mounting and height specifications. Exact text and numbering will be established during the submittal process.
   a. Plaque Type "A" = Typical Classroom/Learning Environment

b. Plaque Type “B” = Typical Office
c. Plaque Type “C” = Typical Conference Room/Shared Use Area
d. Plaque Type “D” = General Purpose (including exit signage)
e. Plaque Type “F” = Typical @ Exterior Doors (installation on exterior side – shall be an exterior-rated sign)
f. Plaque Type “G” = Typical Single User Restroom
g. Plaque Type “H” = Typical Girls/Womens Restroom (Multi-User)
h. Plaque Type “I” = Typical Boys/Mens Restroom (Multi-User)
i. Plaque Type “J” = Elevator (provide one at each elevator stop)
j. Plaque Type “K” = Typical Restricted Access (Mechanical Rooms, Electrical Spaces, etc.)

B. Room Numbers, Symbols, and Restroom Copy:
1. Shall be matte finished acrylic, raised 1/32 inch, of a color contrasting to the face laminate.

2. Characters and pictograms shall be chemically welded to the acrylic backing, through the face laminate, to assure permanent adhesion.

3. Room numbers and restroom copy shall be accompanied by Grade II braille by means of "VisiTouch Duradot System". Glass or metallic "Durodots" shall have 0.059 inch surface diameter with body of sphere pressure secured below face laminate. Routed boxes or glued on dots are not acceptable.

C. Lower or Secondary Copy:
1. Shall be a minimum of 5/8 inch high incised sans serif style, (Helvetica, Optima, Futura, or Arial as selected by Architect), all caps, paint-filled in a color as selected by Architect.

D. Restroom Pictograms:
1. Shall appear on a minimum six (6) inch square, unobstructed field.

E. Window (Slotted) Signs:
1. Shall be open on both ends for an insert by Owner, window shall be a non-glare acrylic window, with an exposed color laminate behind in color as selected by Architect.

F. Fasteners and Accessories:

1. 1/8 inch thick, double-sided foam tape of type recommended to suit application and commercial grade silicone sealant.

2. Back-up plates shall be supplied, where shown or required, for signage mounted on glass.

G. Provide all materials required for a complete installation.

H. Egress Signs:
1. All doors serving as means of egress shall be identified on the interior side of the door with tactile signage indicating “Exit”; this sign shall be equivalent to Plaque “D”. Provide one (1) sign at each door leading to the exterior, whether indicated on the drawings or not. Architect will confirm text.

2.05 OCCUPANCY LOAD SIGNAGE

A. Provide every room or space that is an assembly occupancy one sign with the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or authorized agent.

B. Include assembly area occupancy signage similar to room identification signs.

1. Rooms or areas to have occupancy load signage include but are not limited to the following:

a. Multi-purpose/Collaboration Rooms
b. Cafeteria
c. Platform
d. Weight Room
e. Libraries
f. Gymnasiums
g. Any room having an occupant load of 50 or more where fixed seating is not installed and which are used as assembly areas.

2. Architect shall provide maximum occupancy counts. Signs shall be min. 6'W x 4"H; Architect shall select colors from manufacturer's full range.

2.06 TRAFFIC SIGNS

A. Provide all TAS / ADA approved accessible parking signage and directional signage as indicated on the drawings.

B. Allow for supply and installation of six (6) additional post-mounted signs; to be located as directed by architect.

C. Signage Materials: 0.080 inch thick aluminum or galvanized steel sign with 1-1/2 inch silk screen upper case letters, copy and border. Signs shall have 1-1/2 inch radius at corners typically. Sizes shall be as shown on drawings or required by authorities having jurisdiction.

D. Post Materials: Provided by Section 05 50 00, Miscellaneous Metals.

E. Graphics:

1. Accessibility ("Handicapped Parking") signs with lettering and graphics as detailed. All work shall comply with local codes, ADA, and TAS standards and requirements.

2. "One Way", "Stop", and directional signs with lettering and graphics as detailed. All work shall comply with local codes, and standards ands requirements of authorities having jurisdiction.

3. Post Anchor Bolts: Two (2) galvanized 1/2 inch by 6 inch Neilson anchor bolts welded to steel tube front and back.

F. Accessories:

1. Sign Mounting Hardware: Provide sign mounting hardware of galvanized steel of type and size instructed by manufacturer to suit intended use.

2. Provide concrete footings of 3,000 psi compressive strength at 28 days, unless noted or directed otherwise.

G. Provide all materials required for signage and proper installation.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install signage level, plumb and at height required for disabled accessibility as required by Texas Accessibility Standards (TAS) and ADA. Locate signage as directed by Architect.

B. All architectural signage items shall be securely mounted with first quality anchors; mechanical mounting with sheet metal/wood or tap-in (for concrete block) screws, full threaded, one-way theft resistant. Mount level and square to surrounding surfaces. Location as directed by Architect.

C. At completion of work, clean signage in accordance with manufacturer's instructions. Clean surrounding materials to remove dust, materials, etc.

D. Room Identification Signs:

1. Install in accordance with manufacturer's instructions and in locations shown on drawings. If no locations are shown, room signage shall generally be located on the "public" side of the door indicated to receive the sign. Confirm all locations with Architect prior to installation.

2. Installation shall be by means of double sided tape and silicone.

3. Tactile characters on signs shall be located a min of 48 inches above finished floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above finished floor or ground surface measured from the baseline of the highest tactile character on the wall adjacent to the latch side of the door.

4. Signs containing tactile characters shall be located so that a clear floor space of 18 inches min. by 18 inches min., centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degrees open position.

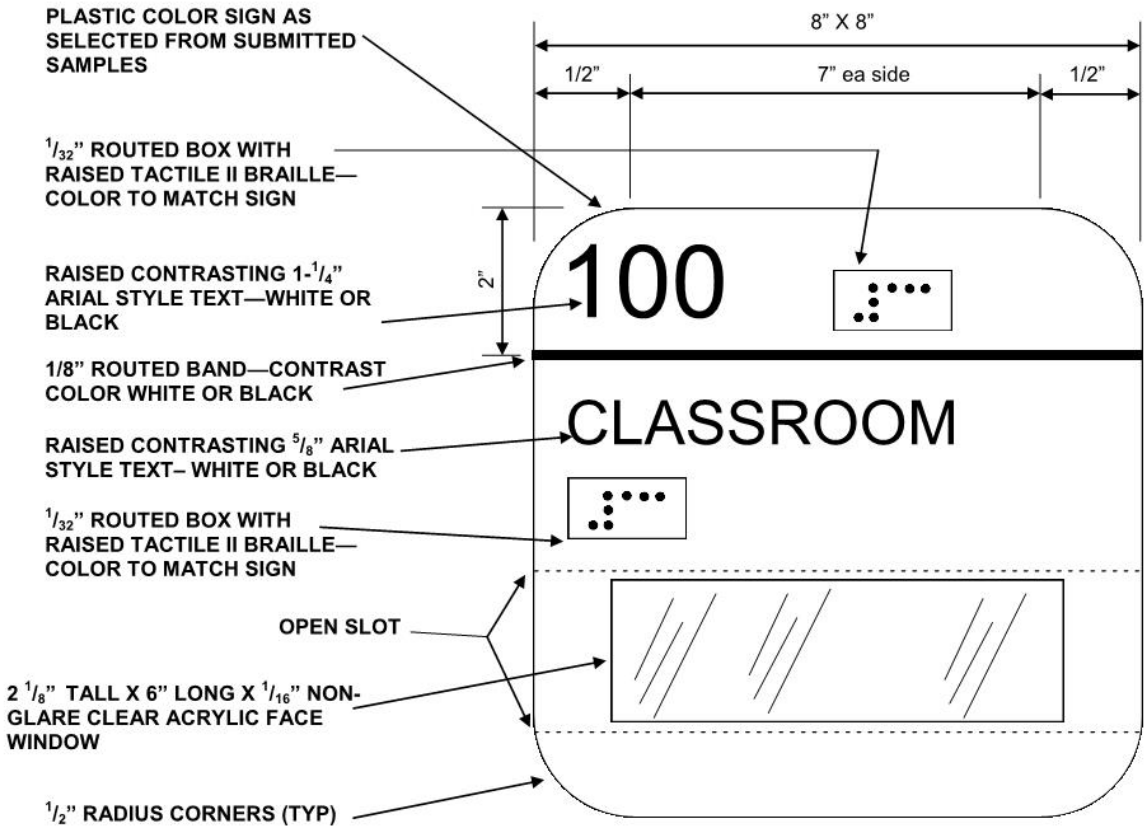
5. Signs with tactile characters shall be permitted on the push side of doors with closers and without hold-open devices

6. Where there is no wall space, including double leaf doors, sign shall be placed on the nearest adjacent wall.

7. Where shown or required, mount signs on glass using back-up plates.

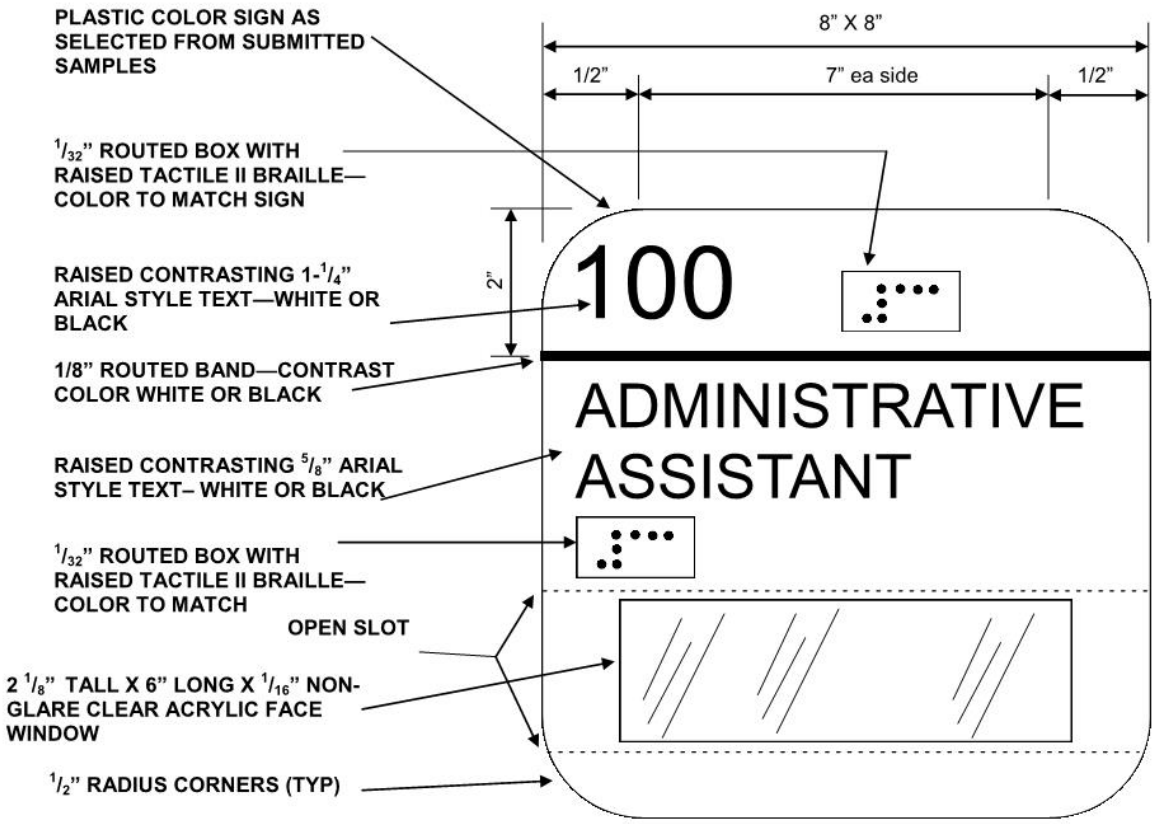
E. Traffic Signs:

1. Install sign posts in concrete footings as shown on drawings, with signs set to heights as shown on drawings. Install signs on posts in accordance with manufacturer's instructions.



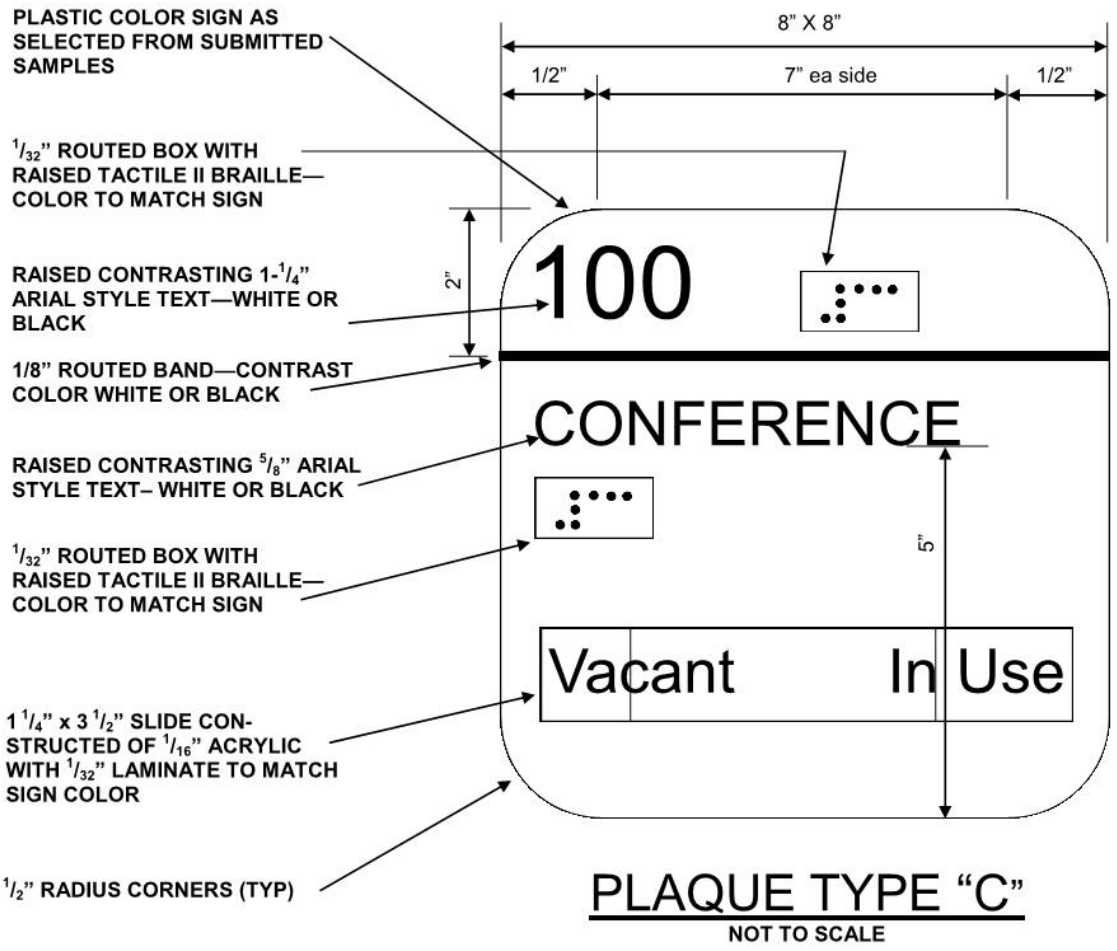
PLAQUE TYPE "A"

NOT TO SCALE

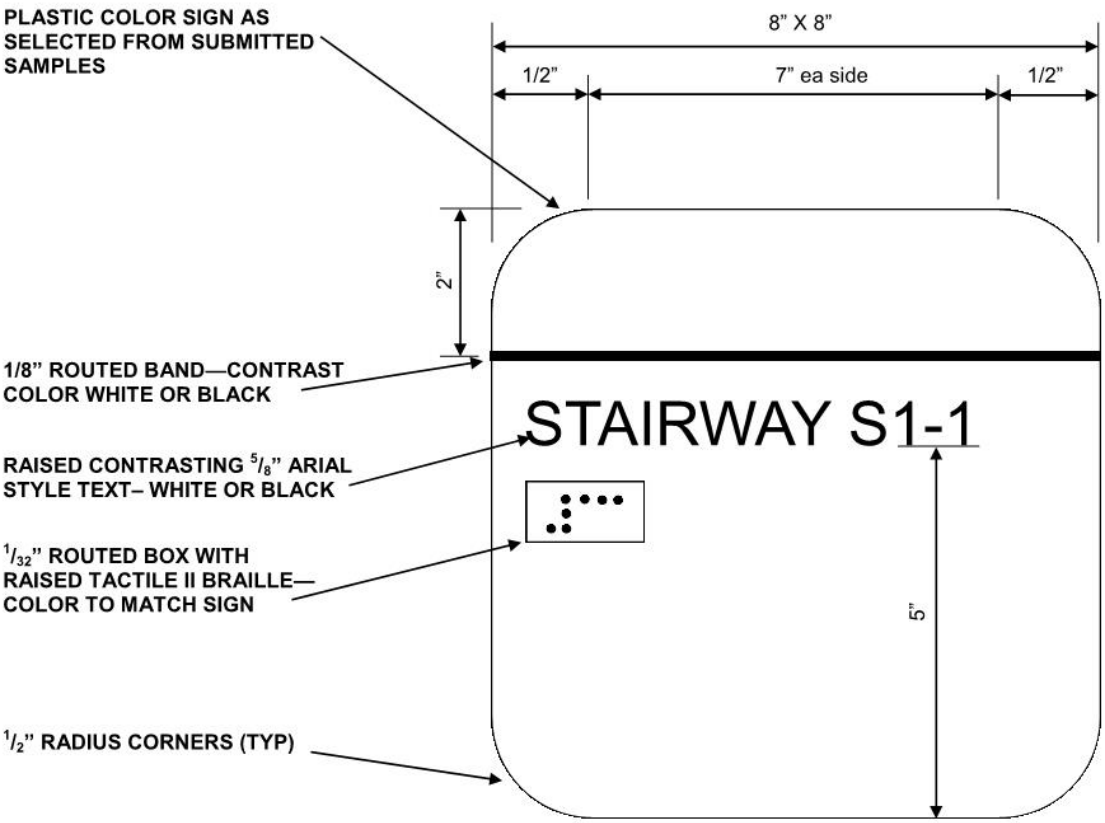


PLAQUE TYPE "B"

NOT TO SCALE

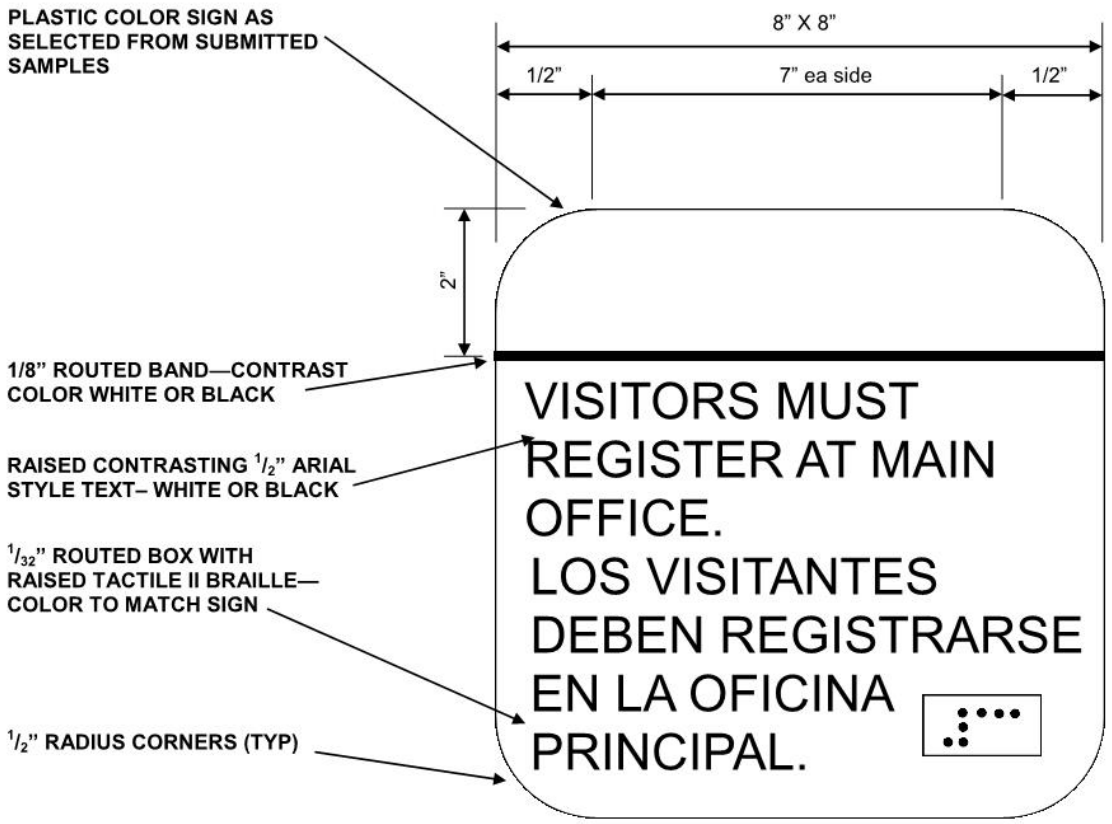


PLAQUE TYPE "C"
NOT TO SCALE



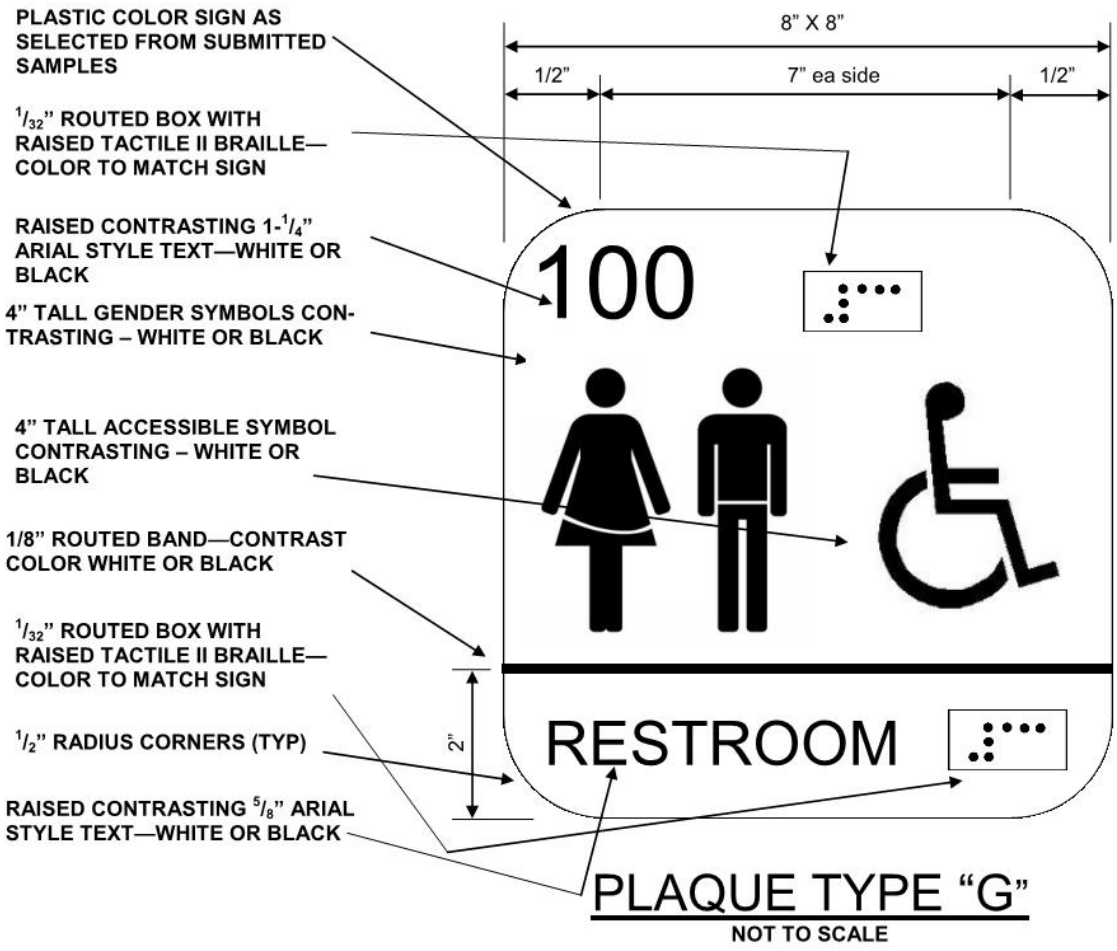
PLAQUE TYPE "D"

NOT TO SCALE



PLAQUE TYPE "F"

NOT TO SCALE



PLAQUE TYPE "G"
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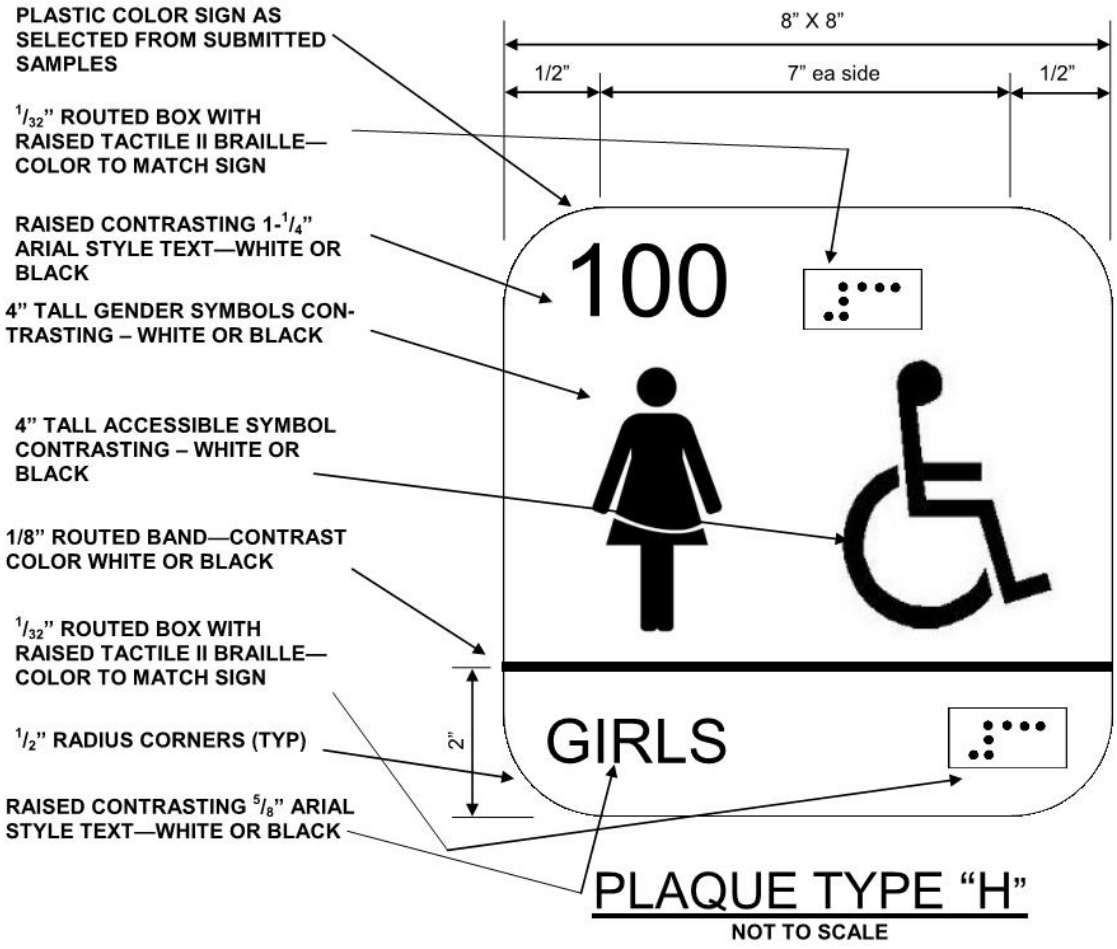

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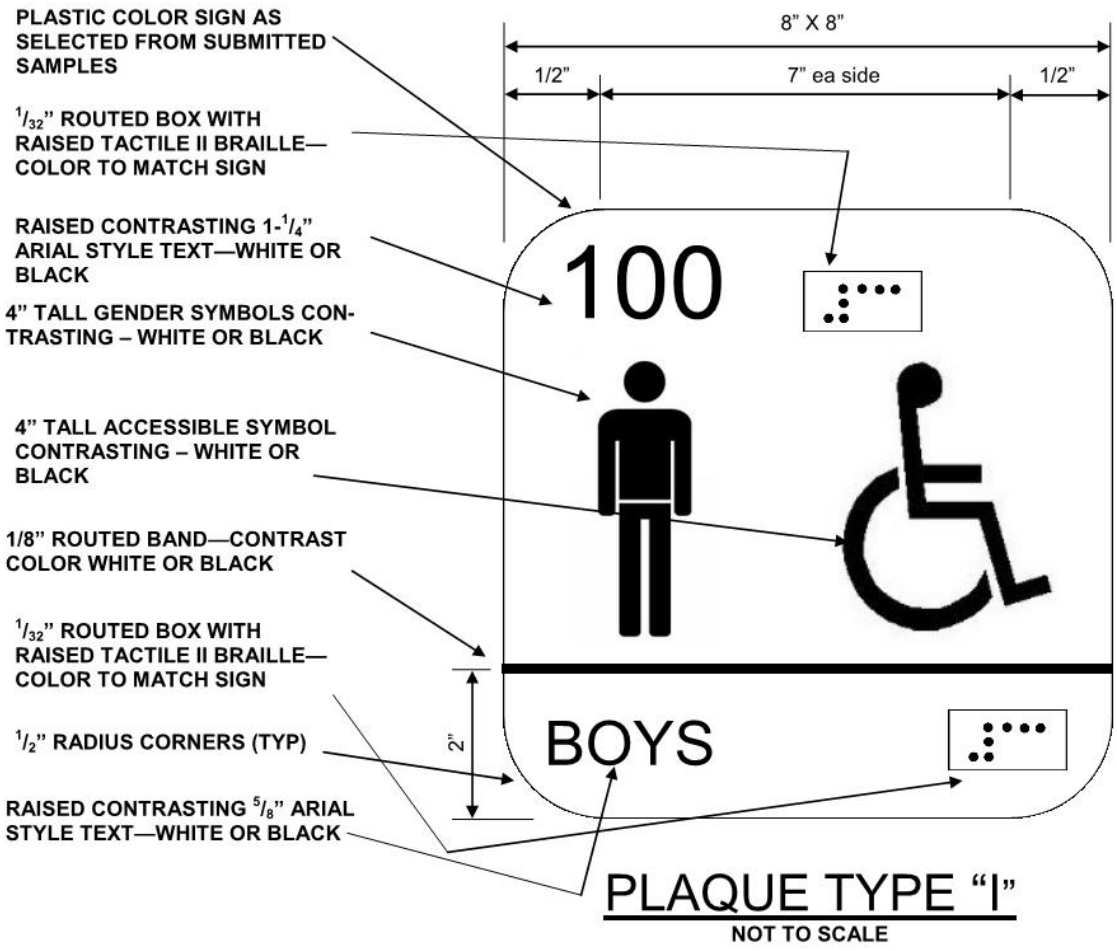

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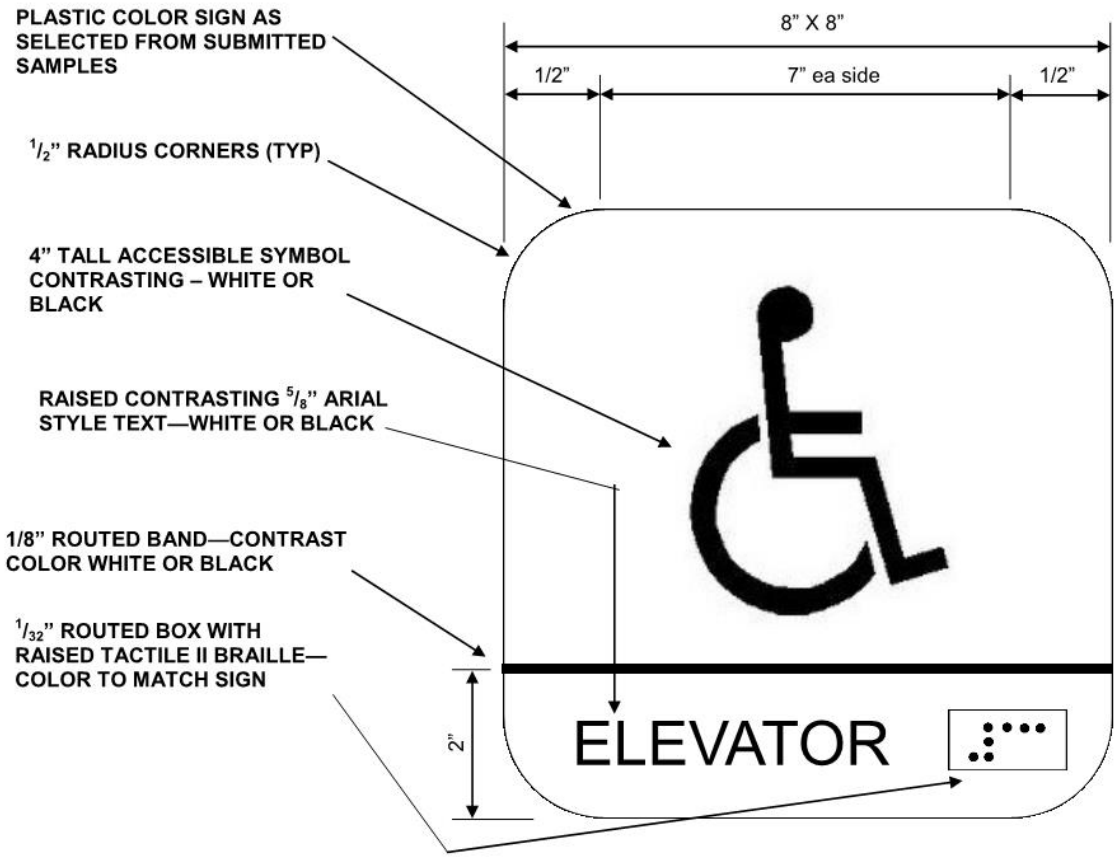

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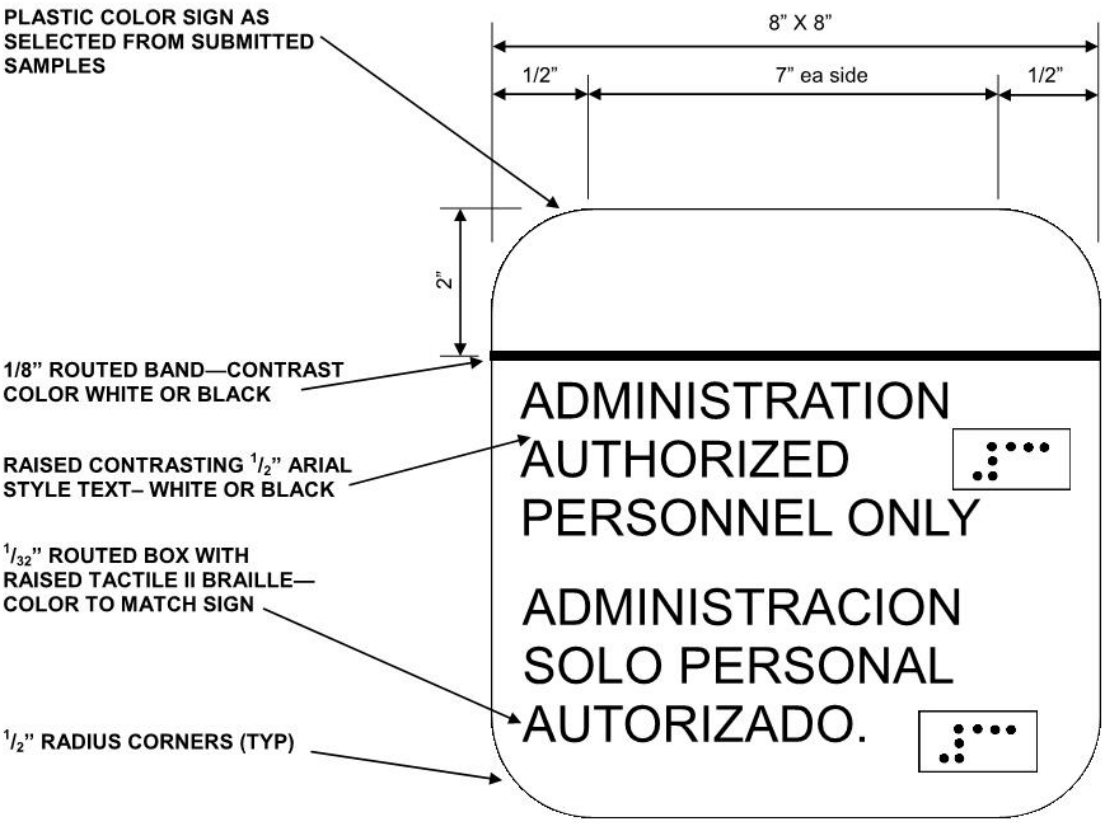

PLAQUE TYPE "K"
NOT TO SCALE

END OF SECTION 10 14 00

SECTION 10 21 16 SOLID PLASTIC TOILET PARTITIONS

PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install, with qualified personnel, floor mounted, overhead braced, solid plastic toilet and urinal partitions and shower compartments if indicated on drawings. Coordinate with other trades as required. Furnish shop drawings and samples. Field verify existing conditions prior to submittal of shop drawings to ensure proper fit to field conditions.

1.02. WORK INCLUDED

Work of this Section shall include, but is not limited to:

a. Toilet compartments, compartment doors, urinal screens, shower and dressing compartments, privacy screens and entry partitions. (Refer to drawings for exact component requirements and configurations).

b. Hardware for compartments and partitions.

c. Shop drawings and working drawings.

d. Manufacturer's guarantee.

e. Related work shall include accessories and anchorage/blocking for attachment of partitions.

1.03 SUBMITTALS

A. Submit six (6) sets of shop drawings and details for approval.

B. Submit complete set of actual HDPE samples for color selection. Provide FULL RANGE of colors and patterns available. Color cards, brochures and printed color charts are not acceptable.

1.04 REFERENCES

A. Toilet compartment sizes, door sizes and urinal screen sizes shall conform to all requirements of latest ADA and TAS minimum requirements as indicated on the ADA standards as shown in the drawings.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

1. Bradley Corporation
2. Global Partitions, Inc.
3. Scranton Products – Basis of Design
4. Hadrian, Inc.

2.02 MATERIALS

A. Door, Panel and Pilaster construction: Shall be not less than 1” thick constructed of solid, High-Density Polyethylene (HDPE) or Polypropylene (HDPP) resins, seamless, with eased edges, compounded under high pressure, forming a single component which is waterproof, nonabsorbent and self-lubricating surface which resists marks from pens, pencils, markers and other writing instruments. All plastic components shall be covered with a protective plastic masking.

1. Maximum width for single panel in any stall to be 60”. Provide intermediate floor supported, overhead braced pilaster for any partition where stall dimension exceeds 60”.

B. Doors and dividing panels shall be 55 inches high and mounted 14 inches above the finished floor.

C. Pilaster shoes shall be 3” high and made of one-piece stainless steel.

D. Pilasters shall be 82” high (standard) and fastened into a 3” high pilaster shoe with a stainless steel torx head sex bolt.

E. Urinal Screens: Provide with vertical supports anchored to floor and braced overhead to walls or adjacent toilet compartments. Attach to wall with continuous double-ear aluminum wall bracket channel full length of screen.

F. Shower Compartments

1) Related work specified elsewhere shall include accessories and anchorage/blocking for attachment of shower cubicles.

2) Colors shall be selected from the manufacturer's full range of 23 standard colors.

3) Shower Cubicles and hardware to be supplied by same manufacturer providing partitions.

4) Shower Cubicle panels and pilasters shall be 1" thick constructed from High-Density Polyethylene (HDPE) resins. Shower cubicles shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. All plastic components shall be covered with a protective plastic masking.

a. Panels and pilasters shall be 1" thick with all edges rounded to a 1/4" radius.

b. Panels shall be 76" high and mounted to pilaster with continuous aluminum double-ear brackets to panels with continued shower corner or bracket.

c. Pilasters shall be 82" high and mounted to panels with 82” long continuous aluminum brackets corners. The pilasters shall be overhead braced with an anti-grip extruded aluminum headrail.

d. Shower corners shall be 76" long and made of aluminum. Shower corners are fastened to panels and pilasters with tamper resistant torx head screws.

e. Headrail shall be made of heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design and a curtain track integrated into its design. The headrail shall have a bright clear anodized finish and shall be fastened to the tops of pilasters and to the headrail brackets with stainless steel, tamper resistant torx head sex bolts.

f. Headrail brackets shall be anodized aluminum with a satin finish, and secured to the wall with #14 galvanized screws.

g. Shower curtains shall be constructed from vinyl and shall be 42" wide by 72" high.

h. Shower hooks shall be aluminum with a self-lubricating nylon sliders.

5) Install Shower Cubicles rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings and manufacturer's installation instructions.

6) No evidence of cutting, drilling, and/or patching shall be visible on the finished work.

7) Finished surfaces shall be cleaned after installation and be left free of all imperfections.

2.03 HARDWARE

A. DOOR HINGES: Shall be continuous, full-height stainless steel piano hinges, surface mounted and through bolted to doors and pilasters with stainless steel, torx head sex bolts. Hinge operation by means of adjustable nylon cams. Cams to be capable of being field set in 30 degree increments. Partition doors at accessible stalls shall be field-adjusted to be self-closing.

B. DOOR STRIKE / KEEPER: Door strike / keeper shall be continuous and made of heavy duty extruded aluminum (6436 - T5 alloy) with a bright dip anodized finish, with wrap around flanges that are at least 5/32" wall thickness, and secured to the pilasters with galvanized, torx head sex bolts. Bumper shall be made of extruded black vinyl.

C. LATCH AND HOUSING: shall be made of heavy-duty extruded aluminum (6463-T5 alloy). The latch housing shall have a bright dip anodized finish, and the slide bolt and button shall have a black anodized finish.

D. COAT HOOK / DOOR BUMPER: Each door shall be supplied with one coat bumper/hook made of chrome plated zamak. Outswing doors shall be supplied with one door pull and one door stop made of chrome plated steel.

E. WALL BRACKETS: Wall brackets for screen panels shall be 54” long. Wall brackets for pilasters shall be 81” long, available in double ear or “H” design and made of extruded aluminum (6463-T5 alloy). Wall brackets shall be fastened to the pilaster with galvanized steel, tamper resistant torx screws and fastened to the panels with galvanized, torx head sex bolts.

F. HEADRAIL: Headrail shall be made of 16-gauge heavy-duty extruded aluminum (6463-T5 alloy) with anti-grip design and a curtain track integrated into its design. The headrail shall have a bright dip anodized finish and shall be fastened to the headrail bracket by a galvanized steel, torx head sex bolt, and fastened to the top of the pilasters with galvanized steel, tamper resistant torx screws.

G. HEADRAIL BRACKETS: Headrail brackets shall be heavy duty anodized aluminum with a satin finish, and secured to the wall with #14 galvanized steel screws.

H. DOOR PULL: Manufacturer's standard unit at outswinging doors that complies with accessibility requirements of authorities having jurisdiction. Provide units on both sides of doors at compartments indicated to be accessible to people with disabilities.

2.04 ACCESSORIES

A. See specification section 10 80 00 for toilet paper holder and grab bars.

B. Provide reinforcing for toilet paper holders, grab bars and accessories.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine areas to receive toilet partitions, screens, and shower compartments for correct height and spacing of anchorage/blocking and plumbing fixtures that may affect installation of partitions. Report any discrepancies to the architect.

B. Take complete and accurate measurements of complete toilet compartment locations. Start of work constitutes acceptance of job.

3.02 INSTALLATION

A. Install petitions rigid, straight, plumb, and level manor, with plastic laid out as shown on shop drawings and manufacturer's installation instructions.

B. AII doors and panels to be mounted at 14" above finished floor.

C. At all areas where partitions are attached to masonry, use metal toggle bolts (butterfly bolts); plastic expansion shields are not allowed.

D. At drywall partitions, attachment shall be to solid fire-treated 2x blocking between metal studs.

E. All items shall be attached with adequately spaced and sized non-removable screws/anchors.

F. Doors and stiles shall be in alignment with no hardware extending below bottom line or above top line of door. Floor fastenings shall be adjustable. Provide headrail continuous across doors and stiles and return headrail back to wall over all end partitions

G. Clearance at vertical edges of doors shall be uniform top to bottom and shall not exceed ¼"

H. No evidence of cutting, drilling, and/or patching shall be visible on the finished work. Finished surfaces shall be cleaned after installation and be left free of all imperfections.

3.03 WARRANTY

A. Provide written warranty to guarantee plastic components against breakage, corrosion, and delimitation under normal conditions for 15 years from the date of receipt by the customer. If materials are found to be defective during that period for reasons listed above, the materials will be replaced free of charge.

END OF SECTION 10 21 16

SECTION 10 21 23 CUBICLE CURTAINS AND TRACK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Curtain track and curtain carriers.
2. Cubicle curtains.

B. Install at locations indicated on the drawings.

C. REFER TO SECTION 10 28 00 – TOILET AND BATH ACCESSORIES FOR SHOWER CURTAINS AND RODS (IF REQUIRED)

1.3 PERFORMANCE REQUIREMENTS

A. Curtains: Provide curtain fabric with the following characteristics:

1. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.

a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

A. Product Data: Include durability, laundry temperature limit, fade resistance, and fire test response characteristics for each type of curtain fabric indicated.

B. Shop Drawings: Show layouts and types of cubicles, size of curtains, number of carriers, anchorage details, and conditions requiring accessories. Indicate dimensions taken from field measurements.

C. Samples for Initial Selection: For each type of curtain material specified.

D. Samples for Verification: For each type of product required. Samples of size indicated below.

1. Curtain Fabric: 12 inches square swatch. Mark top and face of material.
2. Mesh Top: Not less then 4 inches.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install cubicles until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for project when occupied for its intended use.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Arnco (A.R. Nelson Co.) www.arnelson.com
B. Construction Specialties (General Cubical) https://www.c-sgroup.com/cubicle-curtains-and-tracks
C. Automatic Devices Company, www.automaticdevices.com
D. In-Pro Corporation, www.inprocorp.com

2.2 CUBICLE CURTAIN TRACK

A. Track to be equal to “Ultra Cube Cubicle Track”, Model CE8000-AN by In-Pro Corp. www.inprocorp.com , or approved equal.

B. Extruded Aluminum Track: Cubicle track shall be clear anodized, extruded 6063-T5 aluminum, 1 1/8” by 1 1/4” by .050” wall thickness, one piece, and surface mounted.

1. Curved track: Factory-fabricated, 12”, 24” or 36” inch legs available in 45°, 60°, and 90° radius bends. Provide specialty bends if required according to track layout as shown on the drawings

2. Finishes: clear anodized finish.

C. Track Accessories: Fabricate splices, end caps, and snap outs from same material and with same finish as track.

1. End Stop/Cap: Removable with carrier hook.

D. Ceiling Grid Clips: Attached track to suspended ceiling grid using nylon grid clips suitable for installed ceiling grid. Provide swivel clips at curved track.

E. Curtain Carriers: CE9038 Ball and chain carrier; two wheel nylon roller with steel bead chain and hard aluminum hook, 2.2 per foot.

2.3 CUBICLE CURTAINS

A. Manufacturer: Subject to compliance with requirements, provide products by the following:
1. Fabric Manufacturer: In-Pro Corporation www.inprocorp.com. Imperial is an approved equal.

2. Pattern Name: As selected from Shield Designer, Shield Classic or EZE-Guard Fabrics by In-Pro Corp. Submit complete range of standard colors in these fabrics.

3. Color: As selected from manufacturer’s standard (submitted samples)

B. Curtain Grommets: Two-piece, rolled-edge, rustproof aluminum; spaced not more than 6 inches o.c.; machined into top hem.

C. Mesh Top: No. 50, 19" Wide, 1/2" Hole flame resistant nylon mesh.

D. Curtain Tieback: Flame resistant, woven polyester strap with self adhesive aluminum wall plate.

E. Baton: 3/8 inch diameter fiberglass shaft with hook.

2.4 CURTAIN FABRICATION

A. Fabricate curtains to comply with the following requirements:

1. Width equal to track length from which curtain is hung plus 10 percent added fullness, but not less then 12 inches added fullness.

2. Length equal to floor-to-ceiling height minus 19 inches from finished ceiling at top, and minus distance above the finished floor at bottom as follows:

a. Cubicle Curtains: 15 inches

3. Top Hem: To be 1-1/2 inches wide, triple thickness, and double locked stitched.

4. Mesh Top at cubicle curtain: To be No. 50, 19" Wide, 1/2" Hole double lock stitched to top of curtain fabric, with a 1/2 inch wide triple thick top seam. Mesh to have a 1-1/4 inch 100% flame resistant polyester tape double lock stitched into top hem for secure machining of grommets.

5. Bottom Hem: To be 1-1/2 inches wide double thickness double lock stitched.

6. Side Hem: To be 1/2 inch wide turned and single lock stitched.

B. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with installer present, for compliance with requirements for installation tolerance, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install tracks level and plumb, according to manufacturer’s written instructions.

1. Curtain Track Mounting: Surface.

B. Track Accessories: Install splices, end caps, connectors, end stops, snap outs, and other accessories as required for a secure and operational installation.

C. Curtain Carrier: Provide curtain carrier adequate for 6 inch spacing along full length of curtain.

D. Curtains: Hang curtains on each curtain track. Secure with curtain tieback.

END OF SECTION 10 21 23

SECTION 10 22 26 OPERABLE PARTITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is certified in writing by the operable partition manufacturer, as qualified to install the manufacturer's partition systems for work similar in material, design, and extent to that indicated for this Project.

B. Acoustical Performance: Test operable partitions in an independent acoustical laboratory in accordance with ASTM E90 test procedure and classified in accordance with ASTM E413 to attain no less than the STC rating specified. Provide a complete and unedited written test report by the testing laboratory upon request.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 *StandardPractice for Architectural Application and Installation of Operable Partitions*.

1.3 REFERENCE STANDARDS

A. ASTM International
1. ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions.
2. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
3. ASTM C1036 - Standard Specification for Flat Glass.
4. ASTM C1048 - Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
5. ASTM E84 - Surface Burning Characteristics of Building Materials.
6. ASTM E413 - Classification for Rating Sound Insulation

B. Health Product Declaration Collaborative
1. Health Product Declaration Open Standard v2.1

C. International Standards Organization
1. ISO 14021 - Environmental Labels and Declarations - Self-Declared Environmental Claims (Type II Environmental Labeling).
2. ISO 14025:2011-10, Environmental Labels and Declarations - Type III Environmental Declarations - Principles and Procedures.
3. ISO 14040:2009-11, Environmental Management - Life Cycle Assessment - Principles and Framework.
4. ISO 14044:2006-10, Environmental Management - Life Cycle Assessment - Requirements and Guidelines.
5. ISO 21930 – Sustainability in Buildings and Civil Engineering Works — Core Rules for Environmental Product Declarations of Construction Products and Services.

D. Other Standards
1. ADA – Americans with Disabilities Act.
2. UL 508A – Standard for Industrial Control Panels
3. NFPA 70 – National Electrical Code
4. ANSI Z97.1 - Safety Glazing Materials Used in Buildings.
5. CPSC 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
6. NEMA LD3 - High Pressure Decorative Laminates.

1.4 SUBMITTALS

A. Product Data: Material descriptions, construction details, finishes, installation details, and operating instructions for each type of operable partition, component, and accessory specified.

B. Shop Drawings: Show location and extent of operable partitions. Include plans, elevations, sections, details, attachments to other construction, and accessories. Indicate dimensions, weights, conditions at openings, and at storage areas, and required installation, storage, and operating clearances. Indicate location and installation requirements for hardware and track, including floor tolerances required and direction of travel. Indicate blocking to be provided by others.

C. Setting Drawings: Show imbedded items and cutouts required in other work, including support beam punching template.

D. Samples: Color samples demonstrating full range of finishes available by architect. Verification samples will be available in same thickness and material indicated for the work.

E. Reports: Provide a complete and unedited written sound test report indicating test specimen matches product as submitted.

F. Create spaces that are healthy for occupants.
1. Furnish products and materials with Health Product Declaration (HPD), Manufacturer Inventory, or other material health disclosure documentation. Products without an HPD or other disclosure documentation are not acceptable.

G. Furnish materials that generate the least amount of pollution.
1. Furnish products and materials that have third party verified environmental product declarations (EPD's). Consider products and materials that have optimized environmental performance (reduced life cycle impacts). Products without an EPD or other disclosure documentation are not acceptable.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Clearly mark packages and panels with numbering systems used on Shop Drawings. Do not use permanent markings on panels.

B. Protect panels during delivery, storage, and handling to comply with manufacturer's direction and as required to prevent damage.

1.6 WARRANTY

A. Provide written warranty by manufacturer of operable partitions agreeing to repair or replace any components with manufacturing defects.

B. Warranty period: Two (2) years.

PART 2 – PRODUCTS

2.1 MANUFACTURERS, PRODUCTS, AND OPERATION

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:
1. Modernfold, Inc. – Basis of Design
2. Moderco

B. Substitutions: Refer to section 01 25 13.

2.2 OPERATION

A. Basis of Design: Acousti-Seal Premier – Electric Partition (933E) by Modernfold; Series of continuously hinged flat panels, electrically operated, top supported with operable floor seals

B. Final Closure:
1. Side Jamb with overlapping trail panel.

C. Partition shall be operated by:
1. Two push button control stations wired in series and located on opposite sides and opposite ends of the partition. Control stations shall be activated by key switch at stack end of partition.
2. Motor unit shall be reversible, continuous duty, and class A insulated. Motor unit shall have NEMA MG 1 service factor, high starting torque, thermal overload protection, and open/drip proof enclosure. Motor assembly shall have wiring compliant with NFPA 70, 24-volt controls, compliant with UL 508A, and speed of 28 feet/minute. The drive unit motor shall be equipped with outboard limit switches to prevent over-extension. A positive chain drive attached to the lead panel shall pull the partition across the opening. Cable, belt, or other friction type drives will not be accepted.

D. Electric motor: 115-volt, 1-phase, 1 HP, 14.0 FLA

2.3 PANEL CONSTRUCTION

A. Nominal 3-inch (76 mm) thick panels in manufacturer's standard 48-inch (1220 mm) widths. All panel horizontal and vertical framing members fabricated from minimum 18-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.

B. Panel Skin:
1. 1/2-inch (13 mm) NAUF medium density fiberboard, single material or composite layers continuously bonded to panel frame. Acoustical ratings of panels with this construction:
a. 50 STC

C. Hinges for Panels, Closure Panels, Pass Doors, and Pocket Doors shall be:
1. Full leaf butt hinges, attached directly to panel frame with welded hinge anchor plates within panel to further support hinge mounting to frame. Lifetime warranty on hinges. Hinges mounted into panel edge or vertical astragal are not acceptable.

D. Panel Trim: No vertical trim required or allowed on edges of panels; minimal groove appearance at panel joints.

2.4 PANEL FINISHES

A. Panel Face finish shall be (select as required):
1. Reinforced vinyl with woven backing weighing not less than 20 ounces (567 g) per lineal yard.
2. Reinforced heavy-duty vinyl with woven backing weighing not less than 30 ounces (850 g) per lineal yard.

B. Panel trim: No exposed panel trim required or allowed; seals and hardware to be of one color.
1. Architect to select from manufacturer’s color options

2.5 SOUND SEALS

A. Vertical Interlocking Sound Seals between panels: Roll-formed astragals, with reversible tongue and groove configuration in each panel edge, for universal panel operation. Rigid plastic astragals or astragals in only one panel edge are not acceptable.

B. Horizontal Top Seals: Continuous contact extruded vinyl bulb shape with pairs of non-contacting vinyl fingers to prevent distortion without the need for mechanically operated parts.

C. Horizontal Bottom Seals (select one):
1. A2 - Automatic operable seals providing nominal 2-inch (51 mm) operating clearance with an operating range of +1/2-inch (13 mm) to –1-1/2 inch (38 mm) which automatically drop as panels are positioned, without the need for tools or cranks.

2.6 SUSPENSION SYSTEM
A. #14 Suspension System
1. Suspension Tracks: Minimum 7-gage, 0.18-inch (5 mm) roll-formed steel. Track shall be supported by adjustable steel hanger brackets connected to structural support by pairs of 1/2-inch (13 mm) diameter threaded rods. Brackets must support the load bearing surface of the track.
a. Exposed track soffit: Steel, removable for service and maintenance, attached to track bracket without exposed fasteners, and pre-painted off-white.

2. Carriers: All-steel trolleys with steel-tired ball bearing wheels.

3. Warranty period: Ten (10) years.

2.7 OPTIONS
A. Work Surfaces:
1. Markerboard: White enamel on steel, bonded to the face of the panel with horizontal trim without exposed fasteners. Trim is not acceptable on vertical edges to provide uninterrupted work surface.
D. Accessories/Options:
1. Pocket Doors: Acousti-Seal Pocket Doors by Modernfold, Inc. Equipped with electric interlock system.
a. Premier pocket door
2. Finished end caps.

PART 3 – EXECUTION

3.1 INSTALLATION
A. General: Comply with ASTM E557, operable partition manufacturer’s written installation instructions, Drawings, and approved Shop Drawings.

B. Install operable partitions and accessories after other finishing operations, including painting have been completed.

C. Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.

D. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.

3.2 CLEANING AND PROTECTION
A. Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer’s written instructions.

B. Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 ADJUSTING
A. Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 EXAMINATION

A. Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 DEMONSTRATION

A. Demonstrate proper operation and maintenance procedures to Owner's representative.
B. Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION

SECTION 10 26 13 CORNER GUARDS

PART 1 - GENERAL

1.01 Summary
- A. This section includes the following types of wall protection systems:
  1. Corner Guards

1.02 References
- A. National Codes (IBC, UBC, SBCCI, BOCA and Life Safety)
- B. American Society for Testing and Materials (ASTM)

1.03 Submittals

General: Submit the following in accordance with conditions of contract and Division 1 specification section 01 33 00 “Submittal Procedures”:
- A. Product data and detailed specifications for each system component and installation accessory required, including installation methods for each type of substrate.
- B. Shop drawings showing locations, extent and installation details of corner guards. Show methods of attachment to adjoining construction.
- C. Samples for verification purposes: Submit the following samples, as proposed for this work, for verification of guard:
  1. 12" (304.8mm) long sample of each model specified.
- D. Product test reports from a qualified independent testing laboratory showing compliance of each component with requirements indicated.
- E. Maintenance data for wall protection system components for inclusion in the operating and maintenance manuals specified in Division 1.

1.04 Quality Assurance
- A. Installer qualifications: Engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.
- B. Manufacturer’s qualifications: Not less than 5 years experience in the production of specified products and a record of successful in-service performance.
- C. Fire performance characteristics: Provide metal components tested in accordance with ASTM E84 for Class A/1 fire characteristics.
- D. Single source responsibility: Provide all components of the wall protection system manufactured by the same company to ensure compatibility of color, texture and physical properties.

1.05 Delivery, Storage and Handling
- A. Deliver materials to the project site in unopened original factory packaging clearly labeled to show manufacturer.
- B. Material must be stored flat.

1.06 Project Conditions
- A. Installation areas must be enclosed and weatherproofed before installation commences.

Part 2 - Products

2.01 Manufacturers – Basis of Design
- A. SPACE “The Invisible Corner Guard”; Space "The Invisible Corner Guard" | WallandCornerGuard.com
- B. Substitutions: Refer to section 01 25 13 – Substitution Procedures.

2.02 Materials
- A. Made of Lexan / Polycarbonate Resin
- B. 1/8" thick
- C. Length: 4 ft.
- D. Tensile Strength: 300 ft. lbs./sq. in.

E. Rockwell Hardness: 70 (ASTM D-785), IZOD
F. Fire Test: Self-extinguishing
G. Flammability: 94V-2 (UL Bulletin 94)
H. Impact Resistance: 16 ft. lbs./in. (ASTM D-256)
I. Elongation 8%
J. All necessary fasteners to be supplied by the manufacturer.

2.03 Stainless Steel Corner Guards: Basis of Design: Koroseal “Korogard” Series GS40.
Description:
1. 16-gauge stainless steel corner guard adhered with concealed fasteners to substrate. Exposed surfaces to be free of discoloration and any imperfections; 90-degree type.
2. Dimensions: Leg Length = 4” (model #GS40); Corner radius = 1/4”
3. Material: Stainless steel, type 304
4. Finish: #4 Satin

2.04 Fabrication
A. General: Fabricate wall protection systems to comply with requirements indicated for design, dimensions, detail, finish and member sizes.

B. Preassemble components in shop as much as possible to minimize field assembly.

Part 3 - Execution
3.01 Examination
A. Verification of conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
1. Do not proceed until unsatisfactory conditions have been corrected.

3.02 Preparation
A. Surface preparation: Prior to installation, clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as required by manufacturer’s instructions.
B. Protection: Take all necessary steps to prevent damage to material during installation as required in manufacturer’s installation instructions.

3.03 Installation
A. Install the work of this section in strict accordance with the manufacturer’s recommendations, using only approved mounting hardware and locating all components firmly into position, level and plumb.

3.04 Cleaning
A. General: Immediately upon completion of installation, clean material in accordance with manufacturer’s recommended cleaning method.

B. Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.05 Protection
A. Protect installed materials to prevent damage by other trades. Use materials that may be easily removed without leaving residue or permanent stains.

END OF SECTION

SECTION 10 28 00 TOILET AND BATH ACCESSORIES

PART 1 – GENERAL REQUIREMENTS

1.1 SCOPE

A. Provide and install toilet room accessories and mounting devices. Install accessories noted to be furnished by owner and installed by contractor. Location, if not shown on drawings, shall be at location as directed by architect at job site.

1.2 SUMMARY

A. Section includes the following toilet and bath accessory items:

1. Paper Towel Dispensers (OFCI)
2. Toilet Tissue Dispensers (OFCI)
3. Stainless Steel Framed Mirrors – Over Lavatory & Full Height
4. Grab Bars – Shower & Toilet Partitions
5. Baby Changing Station
6. Soap Dispensers (OFCI)
7. Sanitary Napkin Disposal Units
8. Folding Shower Seat
9. Weighted Shower Curtain and Rod
10. Mop / Broom Holder
11. Waste Receptacles
12. Robe Hooks

1.3 SUBMITTALS

A. PRODUCT DATA: Provide data / cut sheets for each item specified, including details of construction relative to materials, dimensions, gauges, profiles, mounting methods, specified colors and finishes.

B. SCHEDULE: Indicate types, quantities, sizes, locations (BY ROOM) for each accessory item to be provided.

C. DRAWINGS: Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for installation of anchorage devices.

1.4 QUALITY ASSURANCE

A. Provide products of same manufacturer for each type accessory unit or units and for units exposed to view in same area, unless otherwise acceptable to the Architect.

1.5 WARRANTY

A. Provide manufacturer's written 5 year warranty against silver spoilage of mirrors, with inclusion to replace any mirrors which develop visible defects within warranty period.

PART 2 – PRODUCTS

2.1 PRODUCTS – APPROVED MANUFACTURERS

A. Based on quality of Bobrick Washroom Equipment, Inc. items are specified to be purchased and installed by contractor.

B. The architect will consider products of comparable manufacturers as a substitution pending the contractor's submission of adequate documentation of the substitution in accordance with procedures indicated in Section 01 25 13 Product Substitution Procedures. Items of equal quality and same design features and standards from the following firms are acceptable:

1. Bobrick Washroom Accessories, www.bobrick.com
2. Gamco Accessories (Bobrick)
3. A & J Washroom Accessories, www.ajwashroom.com
4. American Specialties, Inc., www.americanspecialties.com
5. General Accessory Manufacturing Co., www.gamcousa.com
6. Sloan Valve Co.; www.sloanvalve.com
7. Bradley Corporation; www.bradleycorp.com
8. Pinnacle Dryer Corp. www.pinnacledryer.com
9. World Dryer Corp. www.worlddryer.com
10. KR Specialties, Inc. www.kr-specialties.com

B. Stainless Steel: AISI Type 302/304 with polished No.4 finish, 22 gauge min. thickness unless otherwise indicated.

C. Brass: Flat products ASTM B 19, rods, shapes, forgings ASTM B 16, Castings ASTM B-30.

D. Sheet Steel: Cold rolled commercial quality, ASTM A 366, 20 gauge min. unless noted otherwise. Preparation and pretreatment as required for applied finish.

E. Galvanized Steel Sheet: ASTM A 527, G60

F. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

G. Baked Enamel Finish: Factory-applied, baked acrylic enamel coating. Color as selected in finish schedule from manufacturer's standard colors.

H. Mirror Glass: No.1 quality, ¼" select float glass selected for silvering, electrolytically copper-plated by the galvanic process, and guaranteed for 15 years against silver spoilage. All edges protected by plastic filler strips; back to be protected by nonabrasive, 3/16" thick polyethylene padding.

2.2 ACCESSORIES SCHEDULE (Refer to Drawings for Schedule and Mounting Heights):

A. **TOILET TISSUE DISPENSERS - WALL/PARTITION MOUNTED (TA-3): Bobrick B-2888,** Surface Mounted Double Roll Toilet Tissue Dispenser. Provide 1 at each toilet fixture.

B. PAPER TOWEL DISPENSER (TA-5): Owner-Furnished, **Contractor-Installed**

C. STAINLESS STEEL ANGLE FRAMED MIRRORS:

Bobrick B-290 2436, 24" x 36", Type 304 stainless steel angle framed mirrors. Mount (1) mirror at each lavatory (in addition to other locations noted on the drawings) with concealed, 20 ga., galvanized steel wall hangers. Bottom of reflective

surface of all mirror to be mounted at 40" max. above finished floor. Provide area between mirrors as required for installation of soap dispensers.

Bobrick B-290 2472, 24" x 72", Type 304 stainless steel angle framed mirrors. Mount (1) mirror at each dressing room location noted on the drawings with concealed, 20 ga., galvanized steel wall hangers. Bottom of reflective surface of all mirror to be mounted at 18" max. above finished floor (mount at height indicated on the drawings).

D. GRAB BARS

Bobrick B-6806 x 36, 1 1/2-inch dia. x 36-inch length, stainless steel with snap flanges. Supply and install one grab bar on wall behind toilet for each accessible toilet indicated on plans (provide for minimum of one (1) per toilet room if not indicated otherwise). Design shall meet State of Texas Senate Bill No. 111 - Sixty-first Legislature, as amended by HB 1319 - Sixty-second Legislature. Provide anchors as required for permanently secure installation. Mount grab bars at 33" to 36" above finished floor to the centerline of the bar.

Bobrick B-6806 x 42, 1 1/2-inch dia. x 42-inch length, stainless steel with snap flanges. Supply and install one grab bar on side wall of toilet for each accessible toilet indicated on plans (provide for minimum of one (1) per toilet room if not indicated otherwise). Design shall meet State of Texas Senate Bill No. 111 - Sixty-first Legislature, as amended by HB 1319 - Sixty-second Legislature. Provide anchors as required for permanently secure installation. Mount grab bars at 33" to 36" above finished floor to the centerline of the bar.

Bobrick B-6861 Series, 1 1/2-inch dia. x 15-7/8-inch x 30-7/8-inch length, two-wall, stainless steel with snap flanges. Supply and install one grab bar at each accessible shower indicated on plan (minimum one (1) per shower room if not indicated otherwise).

F. SOAP DISPENSERS: Owner-Furnished, Contractor-Installed

G. SANITARY NAPKIN DISPOSAL: Bobrick Model #B-270, surface mounted, stainless steel, sanitary napkin disposal. Furnish and install one (1) at each female toilet location. Mount top of unit 25" to 30" above finished floor.

H. FOLDING SHOWER SEAT: Bradley Model #956 (9561) or GAMCO Model #SS-4-ADA, reversible, solid phenolic, folding shower seat. Provide 1 seat for each accessible shower indicated on the drawings (provide for minimum of one (1) per shower area if not indicated otherwise). Mount seat at height indicated by TAS.

J. WEIGHTED SHOWER CURTAIN AND ROD:

1. Provide shower curtain and rod at all individual showers.
2. Shower rod equal to **Bobrick Model #B-6047** or **Bradley Model #9531**, extra heavy duty shower curtain rod with stainless steel flanges. Provide 1 at each shower stall location.
3. Weighted Shower Curtain to be equal to Model CUR-130 (36" opening) or CUR-132 (60" opening) as manufactured by KR Specialties, Inc or approved equal. Provide 1 at each shower stall location.

a. Curtain shall be equipped with heavy tape weights in bottom seam engineered and tailored specifically for use in commercial barrier-free, curb-less, or low threshold shower stalls. The curtain must meet or exceed the following requirements. The width shall be a minimum of six inches greater then the pre-determined shower opening. The curtain length shall be a standard 72" height unless custom specified and must touch the floor of the shower to effectively control water spillage. Material shall be a soft polyester fabric, standard color white, machine washable, splash resistant, bacterial resistant, stain resistant, and flame resistant. Material shall meet all state and federal code compliance regulations. Each curtain shall include twelve clear plastic hooks.

K. **MOP & BROOM HOLDER:** **Bobrick Model #B-223 x 36”** **or** **GAMCO Model MS-2** **or** **Bradley Model #9954**, 22 ga., Type 304, stainless steel with 4 spring loaded rubber cams. Provide and install one (1) at each custodian sink location. Mount holder on wall above sinks so that mops will drip into sinks.

L. **BABY CHANGING STATION:** Horizontal design, equal to **Koala Kare/Bobrick Model KB200-00 or Bradley Model # 961**. Provide and install one (1) at each family/single user restroom in public spaces.

M. **WASTE RECEPTACLES:** **Bobrick Model # B-279**; provide at each OFCI paper towel dispenser that is not located over a base cabinet. Waste receptacles shall be installed so bottom edge is no higher than 27” AFF.

N. **ROBE HOOK WITH BUMPER:** **Bobrick B-212**, aluminum, matte finish, with rubber bumper, projects no more than 4-inches. Mount as indicated on drawings. Provide and install one (1) at each individual shower stall, each toilet stall, and each single-user restroom; refer to locations shown on drawings. Allow for one (1) hook per each shower head to be installed in gang-showers (F113.4) – location to be determined by Architect.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify openings are sized and located in accordance with shop drawings.

B. Verify reinforcement and anchoring devices are correct type and are located in accordance with shop drawings.

C. Examine conditions under which construction activities are to be performed, then submit written notification if such conditions are unacceptable.

3.02 INSTALLATION

A. Install accessories in the locations indicated with anchor devices of the types specified. Fasten securely, true, plumb and level.

B. Install recessed accessories into wall openings with wood screws through cabinet side into wood blocking or studs, or sheet metal screws into metal backing or studs.

C. Install surface mounted accessories to hollow back up using toggle bolts and to metal or wood backing using proper type screws.

D. Do not use any anchors, screws, attachment bolts or anchoring sleeves containing lead.

E. Provide fasteners, anchors, and the like as necessary to install toilet accessories.

F. Make required electrical connections.

G. Locate toilet accessories at heights specified by TAS - ADAAG, State, or local requirements.

H. Install all accessories in accordance with manufacturer's written instructions, using attachment appropriate to substrate and as recommended by accessory manufacturer. Install all accessories securely anchored, plumb, level and at heights indicated.

I. Secure mirrors to walls in concealed, tamperproof manner with appropriate hangers, toggle bolts or screws. Set units plumb, level and square at locations indicated, in accordance with manufacturer's instructions.

J. Install grab bars to resist tensile and movement forces generated by a load of 250 lbs. applied in any direction, or as otherwise required by authorities having jurisdiction, whichever is more stringent.

K. At all areas where accessories are attached to masonry walls, use metal toggle bolts; plastic expansion shields are not allowed.

L. At drywall partitions, attach to solid fire-treated 2x blocking between metal studs (butterfly bolts). . All items shall be attached with adequate sized non-removable screws/anchors.

3.03 CLEANING

A. Remove manufacturer's protective coverings and clean surfaces in accordance with manufacturer's recommendations.

3.04 PROTECTION

A. Protect products from damage caused by subsequent construction activities.

B. Field repair of damaged product finishes is prohibited; replace products having damaged finishes caused by subsequent construction activities.

END OF SECTION 10 28 00

SECTION 10 44 13 FIRE EXTINGUISHERS AND CABINETS

PART 1 – GENERAL

1.01 SCOPE

A. Furnish and install fire extinguishers and cabinets at locations shown on the drawings and as specified herein. Coordinate with other trades where such cooperation is indicated by furnishing installation requirements and details along with the material in adequate time for progress of the work.

B. All items shall be installed with anchors appropriate to the wall construction.

C. Securely install, plumb, level, square with surrounding area to height and location as directed by architect.

1.02 SUBMITTALS

A. Submit product data: Include cabinet construction and semi-recessed wall installation details, material descriptions, dimensions of individual components and profiles and finish for cabinets and extinguishers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. J.L. Industries, Inc. http://jlindustries.com
B. Larsen's Manufacturing Co. http://www.larsensmfg.com/

C. Substitutions allowed but must be approved minimum 7 days prior to bid date.

2.02 FIRE EXTINGUISHERS AND CABINETS

A. Provide fire extinguisher cabinet and portable extinguishers of type, size and capacity for each cabinet and other locations as indicated.

B. Corridor locations and all general purpose areas shown on the drawings:

1. **FIRE EXTINGUISHER CABINETS**

a. J.L. Industries, Inc., "Cosmopolitan Series", Stainless Steel Model 1037 with FX option, L-22 door style (solid with Saf-T-Lok and handle), semi-recessed cabinet, 2-1/2" rolled edge trim. All cabinets to have Fire-FX option. Provide horizontal, black, die-cut "FIRE EXTINGUISHER" letters on each cabinet.

OR

a. Larsen's, "Architectural Series", Stainless Steel Model 2409-6R with "flame shield" fire-rated cabinet option, semi-recessed cabinet, 2-1/2" rolled edge trim. Provide solid, stainless steel door with "Larsen-Loc" option and horizontal, black, die-cut "Fire Extinguisher" letters on each cabinet.

2. **FIRE EXTINGUISHER + FIRE BLANKET CABINETS**

a. J.L. Industries, Inc., “Royal Series”, Stainless Steel Model 3637 with FX option, L-22 door style (solid with Saf-T-Lok and handle), semi-recessed cabinet, 2-1/2” rolled edge trim. All cabinets to have Fire-FX option. Provide horizontal, black, die-cut “FIRE EXTINGUISHER” letters and horizontal, red, die-cut “FIRE BLANKET” letters on each cabinet.

OR

a. Larsen’s, FB 3612 (similar to “Architectural Series”, Stainless Steel Model 3612) with “flame shield” fire-rated cabinet option, semi-recessed cabinet, 2-1/2” rolled edge trim. Provide solid, stainless steel door with “Larsen-Loc” option. Provide horizontal, black, die-cut “FIRE EXTINGUISHER” letters and horizontal, red, die-cut “FIRE BLANKET” letters on each cabinet.

3. **FIRE EXTINGUISHERS FOR CABINETS / WALL MOUNT**

a. J.L. Industries, Inc., “Cosmic 10E”, 10 lbs, UL rated 4A-80B:C. Provide 1 extinguisher per cabinet.

OR

a. Larsen’s, MP-10, 10 lbs., UL rated 4A-80B:C. Provide 1 extinguisher per cabinet.

b. In addition to fire extinguishers in public areas of the facility and unless indicated otherwise on the drawings, provide 1 fire extinguisher and wall mount bracket at the following locations:

1) Provide 1 in all electrical rooms
2) Provide 1 in all mechanical rooms
3) Provide 1 in all MDF rooms
4) Provide 1 in all IDF rooms
5) Provide 1 in generator area (if applicable)
6) At all stage areas, provide 1 ea. side (2 total) of stage behind curtain

4. **FIRE EXTINGUISHERS – FOOD PREP AREAS / KITCHENS (BRACKET MOUNTED)**

a. At kitchen areas, provide one (1) Larsen’s WC-CL, 6 liter capacity wet chemical, UL rated 2A:K with 1007 standard bracket mount AND one (1) Larsen’s MP-10, 10 lbs., UL rated 4A-80B:C with standard bracket mount. Surface mount on wall as shown on drawings or as directed by fire marshal.

OR

a. At kitchen areas, provide one (1) J.L. Industries, Inc., “Saturn 15”, 6 liter capacity wet chemical, UL rated K with MB810 mounting bracket AND one (1) “Cosmic 10E”, 10 lbs., UL rated 4A-80B:C with MB846 standard bracket mount. Surface mount on wall as shown on drawings or as directed by fire marshal.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine roughing-in for cabinets to verify coordination so as to not interfer with in-wall mechanical, plumbing or electrical items.

B. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets are to be installed.

C. Examine fire extinguishers for proper tagging and charging. Remove and replace damaged, defective or undercharged units.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing cabinets and extinguishers.

B. MOUNTING HEIGHTS

1. Mount general use fire extinguisher cabinets at a height so that the fire extinguisher handle is at or below 48" AFF. Cabinets or extinguishers that will protrude more than 4" beyond the finish face of the wall shall be mounted so the bottom edge of the cabinet is no higher than 27" AFF (this does not apply to extinguishers located in mechanical/electrical areas).

2. Mount kitchen and special use extinguishers so that the fire extinguisher handle is at or below 48" above finished floor.

3.03 ADJUSTING, CLEANING AND PROTECTION

A. Adjust cabinet doors that do not swing or operate freely.

B. Refinish or replace cabinet doors damaged during installation.

C. Provide final protection and maintain conditions that ensure cabinets, doors and extinguishers are without damage or deterioration at time of Substantial Completion.

END OF SECTION 10 44 13

SECTION 10 51 13 **WEAPONS RACK**

PART 1GENERAL

1.1 SUMMARY

A. Section Includes:
1. Weapons Rack units with retractable doors.

B. Related Sections:
1. Division 01: Administrative, procedural, and temporary work requirements.

1.2 SYSTEM DESCRIPTION

A. Metal Lockers:
1. Configuration: Single tier.
2. Size: 42 inches wide x 16 inches deep x 45 inches high.
3. Diamond pattern perforation to allow visibility of contents within the unit.

1.3 REFERENCES

A. ASTM International (ASTM):
1. A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

1.4 SUBMITTALS

A. Submittals for Review:
1. Shop Drawings: Include dimensioned plans and elevations showing locker layout and relationship to adjacent construction.
2. Product Data: Manufacturer's descriptive data.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 10 years documented experience in work of this Section.

1.6 WARRANTIES

A. Provide manufacturer’s 5 year warranty against defects in materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Tifflin Metal Products Company: www.tiffinmetal.com
B. Substitutions: Refer to section 01 25 13

2.2 MATERIALS AND FABRICATION

A. Construction:
1. Welded frame consisting of a 16 gauge steel top and bottom, 18 gauge diamond pattern perforated steel sides, and 18 gauge diamond pattern perforated steel doors.
2. Optional handles for portable version.

B. Doors:
   1. One piece.
   2. Door assembly riveted to door frame.
   3. Locking mechanism:
      a. 5 point, hasp locking swing latch.
   4. 42”W Unit:
      a. Door type: Double bi-fold.
      b. Full retraction within cabinet when fully opened.
      c. Hinges: 3 per door.

C. Internal Components:
   1. Long weapon storage:
      a. Padded recessed buttstock cutouts 10.
      b. Rubber barrel gripping insert 5.
   2. Handgun storage insert:
      a. Small or Large caliber barrel receiver pins.
      b. User configurable.
      c. PVC coating to protect firearm barrel.

D. Number Plates:
   1. Number doors as directed by customer.

2.3 FINISHES

A. Steel:
   1. Minimum 3 mil thick factory-applied baked-on textured powder coat finish.
   2. Color: Architect to select from manufacturer's full color range.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved Shop Drawings.

B. Set plumb, level, and aligned.

C. Attach lockers to supporting construction with anchors best suited to substrate conditions.

D. Bolt adjacent locker units together to provide rigid installation.

3.2 ADJUSTING

A. Adjust doors and latches to operate correctly.

END OF SECTION

SECTION 10 56 13 METAL STORAGE SHELVING

PART 1 GENERAL

1.01 SUMMARY

A. Section includes: Metal storage shelving units.

1.02 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate shelving locations and configurations; show installation details at special or non-standard conditions.

C. Product Data: Submit for each type of metal shelving unit specified, including physical characteristics, durability and resistance to fading.

D. Samples: Submit two samples, minimum 6 x 6 inches in size, of each color and finish specified.

E. Manufacturer's Installation Instructions: Submit installation instructions for each type of substrate encountered.

1.03 QUALITY ASSURANCE

A. Provide all metal shelving units by a single manufacturer.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Accept metal storage shelving on site. Inspect on arrival for damage.

1.05 COORDINATION

A. Sequence metal storage shelving installation with other work to minimize possiblity of damage and soiling during remainder of construction period.

1.06 WARRANTY

A. Special Project Warranty: Submit a written warranty, executed by the Contractor, Installer and the Manufacturer, agreeing to repair or replace shelving units which fail in materials or workmanship within the specified warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.
   1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 METAL STORAGE SHELVING

A. Manufacturers:
   1. Hi-Line Storage Systems Co. www.hi-line.com
   2. Lyon Metal Products, Inc. www.lyon-metal.com
   3. Penco Products Inc. www.pencoproducts.com
   4. Republic Storage Systems www.republicstorage.com
   5. Shelving Solutions, LLC www.shelvingsolutions.com
   6. Spacesaver Corp. www.spacesaver.com
   7. Substitutions: Section 01 25 13.

2.02 COMPONENTS

A. Sheet Steel: Mild, cold rolled and leveled unfinished steel; minimum 18 gage thick shelves with full box flange construction at front and rear edge; provide higher gage where indicated to provide appropriate loading capacity.

B. Shelving Units: Heavy-duty open shelving units consisting of four upright corner pilasters, 13 gage thick, slotted to receive clips clipped together with shelves as indicated. Provide cross-braces laterally and at ends as required for stability with intended load. Shelves adjustable 1-1/2 inches on center.

1. Size :36 inches wide x 84 inches high unless indicated otherwise.
2. Shelf Depth: Min 18” or as indicated on Drawings.
3. Number of Shelves: As indicated on Drawings; if not indicated, provide fixed bottom and top shelves and 5 intermediate adjustable shelves.
4. Provide sway braces at each side and back of each shelf unit.

2.03 SHOP FINISHING

A. Steel: Manufacturer's standard baked enamel finish, color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect areas and conditions in which metal storage shelving will be installed. Verify locations of power feeds, positioning of exits and aisle ways and overall dimensions of space, including height and HVAC venting.

B. Verify that metal shelving components, including size and finish, are as specified before beginning assembly or installation.

3.2 PREPARATION

A. Vacuum floor surface to remove dust, debris and loose particles. Wet-mop, dry, and finish buff resilient flooring.

3.3 INSTALLATION

A. Install metal storage shelving after finishing operations, including painting, have been completed. Install system to comply with final layout drawings, in accordance with manufacturers instructions. Position units level, plumb, and at proper location relative to adjoining units and related work. Adjust accessories to provide visually acceptable installation.

B. Bolt adjacent shelving units together to form single unit.

C. Field touch-up blemishes to original finish.

3.4 CLEANING

A. Clean steel surfaces in accordance with manufacturer's instructions.

3.5 PROTECTION OF INSTALLED CONSTRUCTION

A. Do not permit finished shelving units to be exposed to continued construction activity.

END OF SECTION 10 56 13

SECTION 10 73 00 PROTECTIVE COVERS

Part 1 – General

1.01 WORK INCLUDED:
Provision, fabrication and installation of Extruded Aluminum Walkway Covers & Canopies, as shown on drawings and specified herein, and as needed for a complete and proper installation.

1.02 REFERENCE STANDARDS: (Specifications for)
1. The Aluminum Association – Aluminum Design Manual 2010
2. American Welding Society- AWS D1.2/D1.2M: 2008
3. ASTM B 209 Aluminum & Aluminum Alloy Sheet and Plate
4. ASTM B 221 Aluminum & Aluminum Ally Extruded Bars, Rods, Wire, Shapes, and Tubes

1.03 SAMPLES:
1. Submit samples in accordance with Section 01-30-00
2. Product data: manufacturer's brochures, manuals and literature.
3. Shop Drawings:
   a. Includes the complete layout, sections, details, components, finishes, sizing, spacing, and fasteners specific to the project. The site-specific shop drawings shall show reactions at surface attachment points and bear the seal of a Registered Structural Engineer.
   b. General Contractor shall submit shop drawings for approval by the Architect prior to fabrication of any materials.
   c. General Contractor to verify all dimensions and elevations prior to submittal to Architect.
   d. Manufacturer shall field verify dimensions prior to fabrication.
4. Finishes: samples of canopy finishes.

1.04 QUALITY ASSURANCE:
1. Canopy shall be designed to comply with state and local building codes.
2. Canopy manufacturer shall have a minimum of 10 years' experience in designing and installing the specified system.
3. The installation of the canopy shall be performed by the manufacturer to assure single source responsibility.
4. Architect will have final approval of the final design.

1.05 MATERIALS:
1. Delivery, Storage, and Handling: protect components from one another during shipping, storage and handling. Exercise care when unloading, storing, and erecting to prevent damage.

1.06 WARRANTY:
1. Provide manufacturer's 1-year warranty against defects in material and workmanship.

Part 2 – Products

2.01 ACCEPTABLE MANUFACTURERS
1. Aluminum Techniques; www.aluminumtechniques.com
2. Avadek www.avadek.com
3 East Texas Canopy; www.easttexascanopy.com
4. Canopy Solutions; www.canopy-solutions.com
5. ARK Metal Builders; Ark (arkmb.com)
6. Substitutions: Refer to section 01 25 113

2.02 MATERIALS:
1. Components: all components shall be 6063, 6061, or 6005 alloy extruded aluminum.
2. Design Criteria: all components shall be sized to comply with live load and wind load requirements of the project and shall not be less than the dimensions shown on the plan.

2.02 COMPONENTS:

1. Configuration: as shown on the drawings
   a. Configuration shall consist of a building suspended system and a post-supported systems
2. Sizes: minimum sizing as shown on the drawings
3. Columns: all columns shall have radius corners
4. Beams: beams are open at top to drain canopy system internally into columns
5. Deck: deck thickness shall be at least .080” thick
6. Flashing: flashing thickness shall be at least .040” thick

2.03 FASTENERS, CONNECTIONS, AND FITTINGS:

1. Bolted Connections: All bolts, nuts, washers, and screws used in joining the members shall be stainless steel up to 3/8” diameter. Over 3/8” diameter may be Hot Dipped Galvanized.
2. General Contractor shall provide structural attachment points flush with the outside surface of the building.
3. Rafters shall be heliarc welded to wall mounting plates which are bolted to walls.
4. Beams are fastened to Rafters with Concealed Clips.
5. Blades are mechanically fastened to structure with Stainless Steel Screws, concealed where able.

2.04 FINISH:

1. Structure: AAMA 607.5 Kynar 500 Flouropolymer Based Painted 2 Coat
   a. Color: Per Color Schedule

2. Soffit: AAMA 607.5 Kynar 500 Flouropolymer Based Painted 2 Coat
   a. Color: Per Color Schedule

Part 3 – Execution

3.01 INSTALLATION:

1. The components and accessories are to be supplied and installed by the manufacturer.
2. Install canopy in strict accordance to manufacturer’s recommendations.
3. Erect canopy after concrete and masonry work in the vicinity is completed and washed down.

3.02 WORKMANSHIP:

1. Take extreme care to prevent damage or scratching. Replace damaged components prior to installation. All workmanship must be top quality with meat miters and fitted joints.

3.03 CLEANING:

1. Just prior to completion of project, strip protective coatings of covering from aluminum and clean all parts. Repair to new condition to replace any materials damaged during installation.

END OF SECTION 10 73 00

SECTION 10 75 16 FLAGPOLE

PART 1 - GENERAL REQUIREMENTS

1.01 SCOPE

A. Provide and install ground-set aluminum flagpole, accessories, foundation and flags.

B. Quantity required:
1. Refer to drawings for quantities and locations.
2. At each flag pole, provide one 5’ x 8’ US flag and one 5’ x 8’ State of Texas flag.

1.02 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide flagpole assemblies, including anchorages and supports, capable of withstanding the effects of wind loads, determined according to NAAMM FP 1001, "Guide Specifications for Design of Metal Flagpoles."

1. Base flagpole design with polyester flags of maximum standard size suitable for use with flagpole or flag size indicated, whichever is more stringent.

2. Basic Wind Speed: min. 95 mph; 3-second gust speed at 33 feet above ground.

1.03 SUBMITTALS

A. Product Data: For each type of flagpole required.

B. Structural Calculations: For flagpoles indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Qualification Data: For professional engineer.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain each flagpole as a complete unit, including fittings, accessories, bases, and anchorage devices, from a single manufacturer.

1. Obtain flagpoles through one source from a single manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General: Spiral wrap flagpoles with heavy paper and enclose in a hard fiber tube or other protective container.

PART 2 - MATERIALS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Flagpole www.americanflagpole.com
2. The Baartol Company Inc. www.baartol.com

3. Concord Industries, Inc. www.concordindustries.com
4. Carrot-Top Industries www.carrot-top.com

5. Concord Industries www.concordindustries.com
6. Eder Flag Manufacturing Co. www.ederflag.com
7. Pole-Tech Company Inc. www.poletech.com
8. Morgan-Francis Co., www.morgan-francis.com
9. United States Flag Store, www.united-states-flag.com
10. Flagpoles Etc. www.flagpolesetc.com

2.02 FLAGPOLES

A. Flagpole Construction, General: Construct flagpoles in one piece if possible. If more than one piece is necessary, comply with the following:

B. Fabricate shop and field joints without using fasteners, screw collars, or lead calking.

C. For tapered flagpoles, provide flush hairline joints using self-aligning, snug-fitting, internal sleeves.

D. Exposed Height: 35 feet.

E. Aluminum Flagpoles: Provide cone-tapered flagpoles fabricated from seamless extruded tubing complying with ASTM B 241/ (B 241 M), Alloy 6063, with a minimum wall thickness of 3/16 inch. Heat treat after fabrication to comply with ASTM B 597, Temper T6.

F. Foundation Tube: Galvanized corrugated-steel foundation tube, 0.064-inch minimum nominal wall thickness. Provide with 3116 inch steel bottom plate and support plate; 3/4 inch diameter, steel ground spike; and steel centering wedges all welded together. Galvanize steel parts, including foundation tube, after assembly. Provide loose hardwood wedges at top of foundation tube for plumbing pole.

1. Provide flashing collar of same material and finish as flagpole.

2.03 FITTINGS

A. External Halyard: Ball-bearing, nonfouling, revolving truck assembly of cast metal with continuous 5/16 inch diameter, braided steel halyard and 9 inch cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.

1. Provide one halyard and one cleat at each flagpole.

2. Provide cast-metal cleat covers, finished to match flagpole, secured with cylinder locks.

3. Provide halyard covers consisting of a 2 inch channel, 60 inches long, finished to match flagpole.

B. Halyard Flag Snaps: Provide four (4) stainless-steel swivel snap hooks per halyard.

C. 6-inch diameter fineal ball and standard; non-fouling ball bearing truck. Cleats: 9” standard cleats.

D. 16-gauge galvanized foundation sleeve with base plate, self-centering wedges and lightning protection ground spike.

E. Continuous braided #10 diameter polypropylene halyard with swivel flagsnaps. Provide cast aluminum cleat cover for padlock installation.

F. Flagpole and all accessories to receive machined 80-120 grit satin-brushed finish.

G. Provide external halyard complete assembly, truck assembly, etc. Provide spun aluminum flash collar.

2.04 MISCELLANEOUS MATERIALS

A. Concrete: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.

B. Sand: ASTM C 33, fine aggregate.

C. Elastomeric Joint Sealant: Single-component neutral-curing silicone joint sealant complying with requirements in Division 7 Section "Joint Sealants" for Use NT (nontraffic) and for Use M, G, A, and, as applicable to joint substrates indicated, O joint substrates.

2.05 FLAGS

A. Commercial-quality nylon, 5 x 8 foot size; furnish one flag of each of the following types:

1. United States,
2. State of Texas.

2.06 FINISHES

A. Metal Finishes, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Aluminum: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

1. Class 1, Clear Anodic Finish: AA-M12C2A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte); Anodic Coating: Architectural Class 1, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.

B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete.

C. Provide forms where required due to unstable soil conditions and for perimeter of flagpole base at grade. Secure and brace forms and foundation tube, sleeve, or anchor bolts in position, to prevent displacement during concreting.

D. Place concrete immediately after mixing. Compact concrete in place by using vibrators. Moist-cure exposed concrete for not less than seven days or use nonstaining curing compound.

E. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.02 FLAGPOLE INSTALLATION

A. General: Install flagpoles where shown and according to manufacturer's written instructions.

B. Foundation-Tube Installation: Install flagpole in foundation tube, seated on bottom plate between steel centering wedges. Plumb flagpole and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2 inch layer of elastomeric joint sealant and cover with flashing collar.

END OF SECTION 10 75 16

SECTION 11 16 19 RAPID ENTRY SYSTEM (FIREMAN LOCK BOX)

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install fireman's lock box near main entry of building or other location as directed by local Fire Marshal or as indicated on drawings.

1.2 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Manufacturer's installation instructions.
3. Manufacturer's operation and maintenance data, as applicable.

1.3 COORDINATION

A. Coordinate Work of this Section with work of other sections in which items are to be installed.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Specifications are based on named products and manufacturers. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.

2.2 MATERIALS

A. Rapid Entry System - Fireman's Lock Box –Knox Box No. 3200 - Vault style (holds max 10 keys, , access cards or entry items).

1. Locate at main entry, at each fire riser room, at main electrical room and each site building. Confirm locations with architect and with Authorities Having Jurisdiction.

B. Provide recess mounting kit or surface mount as required by location.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify items fastened to walls have proper blocking or support items installed.
B. Verify locations for items are ready for their installation.

3.2 INSTALLATION

A. Install all items in accordance with manufacturer's printed instructions in locations shown on drawings or as otherwise directed by Fire Marshal.

3.3 CLEANING AND ADJUSTING

A. Make final adjustment after installation and clean all backstop support piping of dirt and other substances which may affect final finish.

B. Clean all items of dirt and foreign matter which may affect appearance and operation.

C. Adjust items for proper operation.

END OF SECTION 11 16 19

SECTION 11 31 13 RESIDENTIAL APPLIANCES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Furnish and install the following appliances where indicated in the drawings:
1. Refrigerator (Full Size)
2. Commercial Grade Ice Maker
3. Vending Machine (Owner Furnished)
4. Microwaves
5. Washer and Dryer
6. Undercounter Ice maker
7. Dishwasher

1.02 SUBMITTALS

A. Product Data

1. Submit manufacturer's specifications and other data needed to prove compliance with specified requirements.
2. Submit manufacturer's installation instructions.
3. Submit manufacturer's operation and maintenance instructions.

B. Submit sample color charts shown manufacturer's full range of available colors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:
1. EdgeStar
2. GE / Hotpoint
3. Kenmore / Sears
4. Whirlpool Corp.
5. Manitowoc
6. Hanover

2.02 PRODUCTS

A. Refrigerator/Freezer:

1. Top Freezer Type: Freestanding, two-door unit; both compartments frostless, with separate temperature controls; switch for condensation control heating element at freezer opening; storage features including adjustable shelves, meat compartment, vegetable crisper(s), butter conditioning compartment, removable egg trays or bins, door shelves and not less than 2 ice cube trays; reversible doors; adjustable rollers.

a. Capacity: 21.2 cu. ft.

i. Fresh Food 15.1 cu. ft.

ii. Freezer 6.1 cu. ft.

b. Finish: White on white

c. Contractor to adjust door swing when required.

B. Microwave Oven:

1. Capacity: 2.2 cu. Ft.

2. Countertop type

3. Digital touch controls

4. Minimum power 1200W, rated for light commercial applications.

5. Include turntable

6. Finish: White on white

C. Under-counter Dishwasher

7. 162-degree Fahrenheit rinse temperature

8. Sound Level: Maximum 46 dB

9. Tub and Door Liner: Stainless steel with sealed detergent and automatic rinsing aid dispensers.

10. Rack System: 2 plastic utility shelves with stem safe deluxe silverware basket.

11. Controls: Buttons.

12. Finish:

a. White on white except stainless steel at science prep rooms.

D. Residential Washer and Dryer:

1. Washer:

a. Washer drum: Stainless steel, tilted

i. Capacity: 4.9 cu. ft.

b. Spin Speed: Maximum 1250 RPM.

c. Controls: Rotary-electronic dial controls with LEDs for water fill levels, wash/rinse water temperatures, and variable speed and fabric selectors.

d. Wash Cycles: 9 wash cycles, including regular, delicate, and permanent press.

e. Wash Temperatures: Five settings.

f. Speed Combinations: Variable. –

g. Finish: White on white

2. Dryer:

a. Dryer Drum: Stainless Steel

b. Capacity: 8.3 cu. ft.

c. Dryer Controls: Rotary dial controls for drying cycle, temperatures, and fabric selectors.

d. Provide removable lint filter

e. Finish: White on white

E. ICE MACHINE – 310 LB:
1. Approved Product/Manufacturer: Manitowoc IYF0300A Indigo NXT Series 30" Air Cooled Half Dice Ice Machine / Storage Bin - 115V, 1 Phase, 310 lb.
Item #: 499KIY30AD40
2. Size: 30” width
34 1/2” depth
3. 54 1/2” height
4. Ice Type: Half size cubes
5. 24 hour ice yield: 310 lbs

F. UNDERCOUNTER ICE MACHINE – ADA COMPLIANT
1. Hanover 32-lb Reversible Door Ice Maker
2. Dimensions: 34” deep x 15” wide x 23” high
3. 25 lb Ice Storage Capacity

G. Architect to select colors

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where appliances are to be installed to ensure proper opening sizes and that areas are ready to receive appliance installation. Ensure that proper utilities are in place.

3.02 INSTALLATION

A. Install all appliances and equipment in accordance with manufacturer’s printed instructions.

B. Install outside air vents for all electric dryer units specified at each location

3.02 ADJUSTING AND CLEANING

A. Adjust appliances and equipment for proper operation.

B. Clean appliances and equipment of dirt, dust, fingerprints and markings detrimental to good appearance.

C. Remove all manufacturer’s advertising labels not required by law or for proper and safe operation of appliance and clean surfaces.

END OF SECTION 11 31 13

SECTION 11 40 00 FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Documents, apply to the Work specified in this Section.

1.2 SUMMARY OF THE WORK

A. Project Name and Location: Lamar Elementary School #38
Texas

B. Approval of Working Surface: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory conditions. The beginning of work by any contractor shall constitute acceptance of the previous work.

C. Field Verification of All Dimensions: Before ordering any materials or doing any work, field verify all measurements of the building and be responsible for their accuracy. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect or Foodservice Design Professionals (FDP) for instructions before proceeding.

D. Cutting and Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the written approval of the Architect. Each Contractor shall leave all chases and openings straight, true, and of the proper size in their work, as may be necessary for the proper installation of their and other contractors' work. After such work has been installed, the contractor shall carefully fit around, close, repair, patch, and point up the same as directed to the satisfaction of the Architect.

E. Cooperation: The General Contractor, all other contractors, and all subcontractors shall coordinate their work with all adjacent work and shall cooperate with all other trades to facilitate the general progress of the work. Each trade shall afford all the other trades every reasonable opportunity to install their work and store their material.

F. Inspection and Tests: The architect, Owner, Foodservice Design Professionals (FDP), and their representative shall always have access to the work, whether in preparation or progress. Provide proper and safe facilities for such access and inspection.

G. Fees, Permits, and Inspections: Secure and pay fees for all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, codes, rules, regulations, and contract requirements bearing on the work.

1.3 SCOPE OF WORK

A. Include the Work specified, shown, or inferable as part of Food Service Equipment. Portions of this Work may be subcontracted to those qualified to do such work as necessary because of jurisdictional trade agreements and restrictions.

B. The General Contractor is responsible for Related Work specified in other Sections: i.e., final plumbing, electrical and mechanical connections. The Kitchen Equipment Contractor (KEC) is responsible for all internal connections.

C. Specifications and drawings have been prepared to form the basis for procurement, erection, start-up, and equipment adjustment in this contract. Plans and specifications shall be considered mutually explanatory. Work required by one, but not by the other, shall be performed as though required by both. Items required by one but not by the other shall be provided as though required by both. Work shall be accomplished as called for in specifications and shown on drawings so that all equipment items shall be entirely functional for the purpose for which they were designed and intended. Provide all necessary material, tools, equipment, and labor required for the complete delivery, un-crating, erection, and installation as designated on the food service equipment plan and, in the specifications, to be made ready for final connection by the appropriate Division contractors. When there is any discrepancy between drawings and specifications, bidders should seek clarification of any discrepancies from the Architect and or Foodservice Design Professionals (FDP) before bidding.

D. Should the drawings disagree in themselves or the specifications with the drawings *(and clarification was not sought before bidding)*, the higher cost, better quality, more stringent, and greater quantity of the work or materials shall be completed without additional costs to the Owner.

1.4 OTHER DIVISIONS/CONTRACTORS RELATED WORK

A. Division 03 (Concrete) is responsible for but not limited to:

1. Slab depressions reinforced concrete wearing bed at prefabricated walk-in assemblies.

2. Concrete or masonry platforms (with a finished top and coved base at the perimeter) for the raised setting of food service equipment.

3. Slab depressions to receive stainless steel drain trench liner/grate assemblies (provided under this Section).

B. Division 09 (Finishes) responsible for but not limited to:

1. Interior finished floor with a coved base at prefabricated walk-in assemblies.

C. Division 10 (Specialties) responsible for but not limited to:

1. S/S Corner Guards throughout the kitchen (unless specified otherwise).

2. Lockers.

D. Division 22 (Plumbing) is responsible for but not limited to:

1. All connections shall be made in accordance with local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty PVC and wide-sweep bends for refrigerant piping to beverage lines, Co2 lines, and remote food service equipment refrigeration systems.

3. Rough-in and final connection of plumbing systems to food service equipment and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 22. This includes but is not limited to the installation of all faucets (water fill faucets, pre-rinse faucets, etc.), hoses, gas disconnects, and drains from the equipment point of connection to building plumbing systems. All drain lines are provided and installed by Div. 22.

a. Kitchen Equipment Contractor is responsible for providing all faucets (water fill faucets, pre-rinse faucets, etc.), drain fittings, mixing valves, control valves, water pressure regulators, vacuum breakers, and all accessories for equipment specified under 11 40 00. Division 22 is responsible for installation.

4. Indirect drain line runs from the equipment to the nearest drain or floor sink—lines to be type 'K' Copper.

5. If any plumbing accessories or fittings are provided loose with equipment by 11 40 00, Div. 22 is to attach to equipment and provide final connection.

6. Gas Supply Systems with all components and fittings required for a complete system.

7. Water Supply Systems with all components and fittings required for a complete system.

8. Compressed Air Systems with all components and fittings required for a complete system (if required for this project).

9. Piping and Drainage Systems (Sanitary and Grease-laden). ***Systems must be cleaned and flushed before the final connection with food service equipment - Critical.***

10. Floor Sinks (Provide and Install). Flange and grates to be flush with the finished floor.

11. Floor Drains (Provide and Install). Flange and grates to be flush with the finished floor.

12. Trench Drains (Provide and Install). Trench Liners provided by 11 40 00. Flange and liners to be flush with the finished floor.

13. Grease Traps as required (Size, Provide, Locate, and Install). Verify with local codes to bypass or pipe through Grease Trap and/or Interceptor.

14. P-Traps as required (including all disposers).

15. Interconnect water through Water Filter (Filter provided by 11 40 00 unless otherwise specified) to equipment.

16. Gas Quick Disconnect Installation (Quick Disconnect provided by 11 40 00).

17. Safety Restraint Cable Installation (Safety Restraint Cable Provided by 11 40 00).

18. Specified couplings and piping to all equipment furnished by 11 40 00.

19. Air Compressors (if required for this project) (Size, Provide, and Install unless otherwise specified).

20. Water Softeners (if required for this project) (Size, Provide, and Install unless otherwise specified).

21. Pressure Boilers (if required for this project) (Size, Provide, and Install unless otherwise specified).

22. Hand Sinks (Provide (unless otherwise specified) and Install). Provide a hot water tempering valve if required. Water temperature to be at least 100 degrees and flow for at least 20 seconds.

23. Ice Bin Drain Insulation (if Ice Machine is provided in this project) (Provide and Install).

24. Unions at disposer solenoid valves (if Disposer is provided in this project) (Provide and Install).

25. Back Flow Prevention as required (Provide and Install - including all disposers). Back-Siphonage shall be installed at all fixtures and equipment where backflow and/or back-siphonage may occur and where a minimum air gap cannot be provided between the water to the fixture or equipment at its flood/level rim. When furnished with equipment, vacuum breakers shall override the above if acceptable with applicable codes. Division 22 is responsible for verifying requirements with local codes.

26. Janitor Sink with Faucet (Provide and Install).

27. Freeze Proof Hydrant at the exterior of the building by receiving door (Provide and Install - unless otherwise specified).

28. Reverse Osmosis Systems (Size, Provide (unless otherwise specified), Locate, and Install).

29. All piping within the counter body or under fabricated counters must be run to a connection point below the counter body by Section 11 40 00—final connection by Division 22.

30. Exhaust Hood condensate drain connections (if Exhaust Hood is provided in this project) (Provide and Install).

31. Interconnection of ½" CW to Pre-Rinse and Disposers cone/body inlets piped through the solenoid and vacuum breaker (if Disposer is provided in this project).

32. Fire System Piping. The exposed piping is to be chrome plated.

33. Pipe ½" cold water to swirl inlets at disposers (if Disposer is provided in this project).

34. Water Treatment for Ice Builders (Non-Chlorinated water with a PH Level of 10 or Higher) and any drains and overflows. Piping from Ice Builders to Tumble Chillers by Div. 23 (if Ice Builders and Tumble Chillers are provided in this project).

35. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

E. Division 23 (Mechanical) responsible for but not limited to:

1. All connections shall be made following local codes and national standards, except where plans and specifications exceed those codes and standards.

2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.

3. Rough-in and final connection of mechanical systems to food service equipment, walk-in assemblies, and between components (including materials and labor).

4. A mechanical contractor will test and balance rooms and exhaust hoods. **Balance report for food service Exhaust Hoods to be provided to Foodservice Design Professionals (FDP) immediately upon completion (send to Houston.Submittal@fdp.org) and must be submitted with O&M manuals.**

5. Exhaust Hoods, Condensate Hoods, Fire Suppression Systems, connections, and controls (Provide and Install – unless otherwise specified). Provide tempered air at all supply ducts.

    a. If Exhaust/Condensate Hoods and Fire Suppression Systems are specified under Section 11 40 00, Division 23 is responsible for all Exhaust and Condensate Hood connections (Provide and Install).

6. VFD System and controllers when required by code (Provide and Install).

7. Provide and install all ventilation (direct or indirect), air conditioning, and heating systems (unless otherwise specified).

8. Coordinate Supply and Return ducts above Serving Counters. No cold air is to blow directly on hot food counters or open-air refrigerated merchandisers.

9. Coordinate Supply and Return ducts away from equipment with top-mounted refrigeration. No cold air is to blow directly on compressors.

10. Mechanical Contractor to locate temperature monitors within return ducts.

11. Circulating air above walk-in assemblies (Provide and Install).

12. Circulating air above and in air gaps at warehouse cold storage assemblies (Provide and Install).

13. Water Chillers as required (if equipment is provided in this project) (Provide, Size, and Locate).

14. Piping from Ice Builders to Tumble Chillers (if equipment is provided in this project) (Size, Provide and Install).

15. Refer to Section 2.2 PLUMBING / MECHANICAL REQUIREMENTS for additional information.

F. Division 26 (Electrical) responsible for but not limited to:

1. Rough-in and final connection of electrical systems to food service equipment, walk-in assemblies, and between components (including materials and labor). Accessories provided loose with food service equipment by Section 11 40 00 to be field installed by Division 26.

2. Empty EMT Conduit with pull-wire and wide-sweep bends for refrigerant piping to remote food service equipment refrigeration systems.

3. Empty EMT Conduit with pull-wire and wide-sweep bends for interconnect cables between LAN and POS terminals, change-makers, pre-check units, printers, CPUs, etc. Division 26 to verify where the conduit will run for POS System (i.e., Manager's Office or IDF Room).

4. Empty EMT Conduit with pull-wire and wide-sweep bends for fire suppression systems. Interconnect the Fire Protection System to panel box shunt trips and building alarms.

5. Walk-in Assembly Light Fixture Installation (Provided loose by Section 11 40 00) (if Walk-in is provided in this project).

6. Table Limit Switch Installation (Provided loose by Section 11 40 00) (if Dishmachine is provided in this project).

7. Electrical Materials and Devices (Shunt-trip breakers, surge protectors, lighting control devices, conduit, wire, etc.).

8. Switches and Stainless Steel Disconnects as required (Provide, Locate, and Install – to be in an accessible location).

9. Charging Stations for Forklifts, Pallet Stackers, and Pallet Jacks (Size, Provide, Locate, and Install) (if equipment is provided in this project).

10. Interconnection between Condensate Fan and Dishmachine control panel (if equipment is provided in this project).

11. Interconnection between Exhaust Hood fans and switch (if equipment is provided in this project).

12. Interconnection between Exhaust Hood lights and switch (if equipment is provided in this project).

13. Door Heaters, Lights, Coils, and Heated Pressure Relief Ports pre-wired to the junction box at the top of walk-in assemblies (if equipment is provided in this project) provided by Section 11 40 00—final connection by Div. 26.

14. If any electrical accessories, fittings, and cord/plugs are provided loose with equipment by 11 40 00, Div. 26 is to attach to equipment and provide final connection.

15. Provide waterproof receptacles in wet areas.

16. All electrical connections beneath Exhaust Hoods (if equipment is provided in this project) to extend to shunt trip breakers with electrical panel box for shutdown during fire mode.

17. Receptacles will be pre-wired to Junction Box or Load Center for final connection by Division 26.

18. All electrical lighting, power, and distribution systems.

19. Do not interconnect more than three (3) convenience outlets on one (1) breaker.

20. Other than convenience outlets, all electrical connections on food service plans are dedicated breakers.

21. Doorbell at receiving door (Provide and Install –audible throughout Kitchen, Office, and Dry Storage room).

22. Adequate lighting at receiving door.

23. Dedicated circuit for heated drain line connection in Walk-In Freezer (120/1/16.0 Amp) at each coil.

24. (if Walk-in is provided in this project) Provide and install (2) Edwards 860 Series (or equal) red lens, surface-mounted Xenon Emergency Strobe Beacons. One (1) to be located in the Kitchen above Walk-In Freezer door (or Cooler door when Freezer is within Cooler in an ‘inline’ assembly), and One (1) to be located in the Cafetorium (Coordinate location with Owners). Provide all conduit and wiring required and

interconnect the illuminated Push Button Panic Alarm in the Walk-In Freezer to both Strobe Beacons (***Critical***). Coordinate with Division 27.

25. Electrical contractor to provide conduit with pulled wires prior to installation of equipment.

26. Refer to Section 2.5, ELECTRICAL REQUIREMENTS, for additional information.

G. Division 27 (Communication) responsible for but not limited to:

1. Data line coordination for food service equipment.

2. Time clocks as required.

3. Video cameras for learning assistance in food service areas as required (Provide, Locate, and Install).

4. (if Walk-in is provided in this project) (Provide conduit, data line, and interconnect the illuminated Push Button Panic Alarm inside the Walk-In Freezer to the Building Automation System (BAS). When activated, facility personnel are to be notified - coordinate notification requirements with the Owner (***Critical***). Coordinate with Division 26.

H. Division 28 (Electronic Safety and Security) is responsible for but not limited to:

1. Security Cameras as required (Provide, Locate, and Install).

I. General Contractor responsible for but not limited to:

1. Any wall penetration required for food service equipment utilities. Escutcheon plates or S/S sleeves are to be provided and installed as needed.

2. Bulk Freezer Ventilation Pipe (if Bulk Freezer is provided in this project) (Provide and Install unless otherwise specified).

3. Core drilling for Guide Rails (if Guide Rails are provided in this project).

4. Refrigeration Roof Curbs / Roof Jack (if Refrigeration System is provided in this project and located on the roof).

5. Interior Bollards (if required for this project) – to be epoxy painted per local codes (Provide and Install).

6. Furnish and Install ¾" Plywood blocking in the wall for mounting equipment furnished by Section 11 40 00 as required.

7. Walk-in Depressions (to be dead level) and sand leveling bed (if Walk-in is provided in this project and recess is shown).

8. Structural bracing for Bulk Walk-in Assembly ceiling panels if required.

9. Menu System Video Monitors in Servery (unless otherwise specified).

10. Structural bracing for Menu System Video Monitors if required.

11. Interior/Exterior refrigeration penetrations and sleeves at building penetrations.

12. DoorScope viewer (peephole) with wide viewing angle at receiving door.

13. Canopy at receiving door. Coordinate height with the height of Receiving Door (8') and the mounting height of Air Screen above the door.

14. Soap and towel dispenser provided by Owner. G.C. is responsible for installation.

15. Washer and Dryer (Provide and Install, unless otherwise specified).

16. Dwarf wall at exposed front/ends of cafeteria serving counters with the finish as selected by the Architect if required in this project).

17. Final cleaning of all equipment before demonstrations.

1.5 QUALITY ASSURANCE

A. In addition to complying with all applicable laws, statutes, building codes, and regulations of public authorities, comply with the following:

1. National Sanitation Foundation (all equipment to bear label)

2. National Electric Code

3. Underwriters' Laboratories, Inc. (all applicable equipment to bear label)

4. American Gas Association Laboratories

5. National Fire Protection Association

6. Americans with Disabilities Act

7. Food and Drug Administration HAACP Guidelines

8. International Energy Conservation Code (IECC)

9. Department of Energy

10. Environmental Protection Agency

11. CSA Group

B. Furnish certification of regularly manufactured equipment listing or classification by Underwriter's Laboratories, Inc. with the initial submittal.

C. Furnish a list of equipment and components (internal and external) that are not of domestic origin. All equipment and components (internal and external) should be of domestic origin when possible. This information should be provided with the initial submittal.

D. Projects outside the continental United States shall adhere to all local authorities having jurisdiction over that project.

1.6 SUBSTITUTIONS

A. **The specified equipment items or components are intended to be the basis of the bid. All other brands, including any additional names, which may be listed as "Alternates" or "Approved Equal," must conform with the general and item specifications,**

warranties, size/dimensions, quality, accessories, function, voltage, horsepower, etc. of the first-named brand and be subject to Paragraph C-03 of this Article.

B. Proposed Substitutions:

1. Submitted at least 14 calendar days before Bid Date.

2. Submit proposed substitutions with catalogue data and manufacturer's shop details indicating all modifications required to conform with the specified brand.

3. List of deviations must include equipment name, model number, accessories, and features with deviation(s) noted for specified and proposed alternate equipment. Equipment without listed deviation(s) will be considered furnished as specified.

C. Substitutions with prior approval:

1. Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-02.

2. Owner reserves the right to accept or reject any or all substitution proposals before execution of the Contract.

3. Provide all design/engineering services required to adjust in space, systems, utilities, etc., and pay all additional costs of utilities, construction, or professional services that may be incurred due to the acceptance of any substitution.

D. All appliances or other equipment within a common group or category (e.g., refrigerators, kettles, ovens, shelving, etc.) must be from the same manufacturer.

1.7 INTERPRETATION OF DOCUMENTS

A. During Bidding: Bidder's, supplier's, or vendor's questions and comments about Construction Document's clarity or intent will be addressed by addendum.

B. After Award:

1. Clarification Bulletin will confirm Construction Document requirements.

2. Request for Information submitted by Contractor shall contain Contractor's proposed resolution.

1.8 WARRANTY

A. Provide a written warranty for parts and labor for one year ***from the date of Substantial Completion***, including an extended four-year replacement warranty on compressor bodies.

B. Components of equipment subject to replacement before one year's use (such as refrigerator door gaskets) and those items which may fail due to improper or inadequate periodic maintenance by the Owner/Operator (such as an uncleaned refrigeration system condenser) are not intended to be included within the scope of the Warranty.

C. Refrigeration Systems/Equipment: One-year free service available within twenty-four hours of notification.

D. Furnish three copies of a list of all equipment and their respective local service agencies, indicating the address, telephone number, and name of the person to contact. The service agencies selected shall be factory-authorized for the equipment assigned whenever possible.

E. Provide the following for refrigeration systems/equipment unless specified otherwise:

1. One (1) year of free refrigeration system service is available within twenty-four hours of notification.

2. Provide five (5) year manufacturer's registered written replacement warranty certificate covering compressor bodies. Warranty to cover labor costs for the first year.

3. Provide ten (10) years of the manufacturer's registered written replacement/repair warranty certificate covering walk-in assembly panels. Warranty to cover defects in material and workmanship. Warranty to cover labor costs for the first year.

4. Provide two (2) year parts and labor warranty for ***all parts/components (including third-party components that may be utilized)*** of the refrigeration system(s) ***(including freon)***, walk-in cooler(s), and freezer(s) not otherwise covered herein.

F. ***All above-stated warranty periods are from the date of Substantial Completion***. All replacement parts due to a warranty call should be the same quality as the original, or better if the original were defective. Replacement parts should be of a domestic origin where possible.

1.9 SUBMITTAL DATA

A. **All submittals must be received, reviewed, and approved as noted prior to equipment procurement. If any equipment is procured prior to this process, it is on the KEC to replace any equipment, accessories, or other components that may not meet the specifications or design intent for the facility, including all costs associated with rectifying the errors made procuring the equipment before this critical process.**

B. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.

C. Submittal Requirements:

1. Kitchen Equipment Contractor to furnish all submittals via PDF, drawings to be scaled per General Specifications and provided in Three (3) submittal packages.

2. Foodservice Design Professionals requires the below-listed business days for each package submitted. Packages are to be submitted within 14 days between each issued package. Each package should contain individual submittal sets.

a. Package One to include (2) Individual sets: 10 Business Days for Review

i. Equipment rough-in

ii. Equipment Brochure

b. Package Two to include (3) Individual sets: 10 Business Days for Review

i. Exhaust Hoods

ii. Walk-in Cold Storage Assemblies

iii. Refrigeration

c. Package Three to include (4) Individual sets: 15 Business Days for Review

i. Custom Fabrication

ii. Serving Counters

iii. Merchandising Equipment

iv. Miscellaneous Submittals

D. Submittals to be identified with the below-listed file name structure:

1. 11 40 00-1 EQUIPMENT BROCHURE

2. 11 40 00-2 EQUIPMENT ROUGH-IN PLANS

3. 11 40 00-3 CUSTOM FABRICATION

4. 11 40 00-4 SERVING COUNTER

5. 11 40 00-5 EXHAUST HOODS

6. 11 40 00-6 WALK-IN COLD STORAGE ASSEMBLY

7. 11 40 00-7 REFRIGERATION

8. 11 40 00-8 BEVERAGE MERCHANDISER

E. Package One (1) requires both submittals: Brochure and Rough-in plans. **If not sent together, the submittal will be rejected.**

F. Foodservice Design Professionals (FDP) will notate all submittals in RED. Architects and General contractors will be notated in color per their direction.

G. If hard copy submittals are required, Kitchen Equipment Contractor will furnish all copies to the specified trades as required.

H. If discrepancies, missing information, or incorrect information occur within the documents, Kitchen Equipment Contractor is to seek clarification or note the need for further direction on submittals. The Kitchen Equipment Contractor is to bid the higher of the discrepancies. *Refer to Section 1.3 SCOPE OF WORK: Subsection D.*

I. Brochure Format (for regularly manufactured equipment and components):

1. Front and rear protective cover with labelled project name.

2. Brochure index: Indicate Functional Area/Room number, item number, quantity, description, and manufacturer.

3. A separate flysheet for each component or item of equipment, indicating item number, name, quantity, manufacturer, optional equipment, modifications, special instructions, and utility requirements. Any equipment or assembly containing more than one buyout sub-assembly or component shall have the second item listed in parenthesis beside the primary item name—for example, Serving Counter (hot food well).

4. Catalogue specification sheet with all options notated on the specification sheet and manufacturer's drawing.

J. Shop Drawings (Rough-In Drawings):

1. Separate drawing sheets: same size as Contract Drawings (Contract Drawings are not to be traced or reproduced). Submittal drawings are to be provided by Kitchen Equipment Contractor and not copied or reproduced from Contract Documents. Any reproduced submittal drawings will be rejected.

2. ¼" scale drawing of fixed/movable food service equipment and prefabricated Walk-in assemblies with itemized schedules.

3. Special Conditions Drawings, sizing, and locating the following conditions:

a. Slab depressions, cores, sleeves, or block-outs (walk-in assemblies, drain trenches, piping, etc.).

b. Concrete or masonry platforms.

c. Pipe sleeves or roof jacks.

d. Wall openings or block-outs for pass-through equipment, recessed control panels, in-wall fire-protection system components, etc.

e. Blocking grounds or anchor plates required in walls for equipment support/attachment.

f. Above-ceiling hanger assemblies for support of exhaust hoods, ceiling-mounted pot racks, etc.

g. Access panels in walls or ceiling for service of equipment.

h. Ceiling pockets or recesses for unusually high equipment.

i. In-wall carriers for wall-hung or cantilevered equipment.

4. Electrical Rough-In Drawing

5. Plumbing and Mechanical Rough-In Drawing

6. Required information:

a. All fixed and portable food service equipment shown on Contract Drawings.

b. All prefabricated Walk-In Assemblies and Conveyor/Dishtable Assemblies shown on Contract Drawings.

c. All general-use and convenience utilities or services indicated on Contract Drawings, including those required by or connected to equipment or devices, not in this Section.

d. All Rough-In Drawings: Fully dimensioned from engineering benchmark (column lines, when provided) and finished-room surface to the point of stub-up through floor and stub-out through wall or ceiling for all mechanical, electrical, and plumbing services.

e. Connection number/tag system and symbols: Identical to Contract Drawings.

K. Shop Drawings (Manufacturer's and Fabricator's):

1. Sheet Size: Identical to Contract Drawings, drawn or plotted at a ¼" scale for plan view, ½" for elevations, and 1½" for sections and construction details.

2. Included information: The item number, name, and quantity.

3. Construction details, sections, and elevations to reflect the requirements of the Specifications and Drawings.

4. Indicate adjacent walls, columns, and equipment.

5. Indicate plumbing and electrical schematic drawings for equipment such as conveyors, waste systems, self-cleaning exhaust hoods, exhaust hood fire protection systems, and fabricated fixtures with a single electrical or plumbing connection.

6. Mechanical or electrical operating components or products integrated into a fabricated fixture: ventilation and service access required or recommended by the manufacturer, including panel size and location to permit easy lubrication, adjustment, or replacement of all moving parts.

L. All equipment and engineering rough-in plans sheet numbers are to match the contract documents. All equipment item numbers and engineer item numbers located on the schedules are to match the contract documents. All engineering requirements must be updated to accommodate the provided equipment and match the contract documents. The Kitchen Contractor coordinates any MEP revisions to accommodate the supplied and proposed equipment. The Kitchen Equipment Contractor is responsible for any costs associated with equipment substitution.

M. Foodservice Design Professionals (FDP) drawings and schedules are not to be copied in any way. Any replicated drawings of Foodservice Design Professionals (FDP) will be rejected.

1.10 SERVICE MANUAL

A. Three copies bound in 1½" hardback, three-ring binders (as many volumes as required by the scope of the project) with the same data as the brochure after installation (Refer to "Submittal Data"). Provide separate service manuals for each independent area within the project scope (Main Kitchen, Culinary, Concession, etc.).

B. Each Volume: Section for maintenance of finish materials (e.g., stainless steel, plastic laminates, FRP, Plexiglas, etc.).

C. Catalog specification sheet and/or manufacturer's shop drawings.

D. Each Volume: Index of items, manufacturer's operating/maintenance information, replacement parts data, list of all product warranties, and price lists. Provide the name, title, and address of personnel at each respective manufacturer and service personnel to be contacted for spare/replacement parts and service after the warranty period.

E. To the greatest extent possible, provide two copies of the manufacturer's instructional video cassettes for operating, maintenance, and equipment service.

F. Internally subdivide binder contents with permanent page dividers, logically organized by equipment item number or manufacturer name, with tab titling printed under reinforced, laminated plastic tabs.

G. Electronically submitted manuals must follow the formatting requirements listed above.

H. **Service Manual to be provided to the owner before kitchen equipment demonstration.**

1.11 VERIFICATION AND COORDINATION OF PROJECT / DATA

A. Utilities Rough-in Drawings and field verifications are to be completed within four weeks after receipt of notice-to-proceed. Review Contract Drawings and Submittal Data for accuracy and completeness and notify Architect of conflicts and proposed adjustments. Coordinate work with other sub-contractors.

1. KEC to provide on-site field verification of all underground utilities before pouring concrete for capacity and location and coordinate with General Contractor. Submit a review to Architect and General Contractor. If rough-ins need to be relocated, KEC will compensate other trades for the required relocation.

2. KEC to provide on-site field verification of all other utility connections and locations and coordinate with General Contractor. Submit a review to Architect and General Contractor.

B. On-Site Inspection Reports

1. Before concrete pour: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

2. Before delivery of equipment: The Kitchen Equipment Contractor is to submit a copy of the report below to the Architect, General Contractor, and Foodservice Design Professionals (FDP) within 24 hours of the inspection. The form to be submitted is contained within these General Specifications.

FOODSERVICE DESIGN PROFESSIONALS

0n - Site Inspection Report

Prior to Delivery of Equipment

Inspection Date_____ **Project Name** _____

Project Location_____

Inspector's Name_____ **Company** _____

Inspector's Contact Number_____ **Email** _____

Architectural Firm_____ **Project Architect** _____

Architect's Contact Number_____ **Email** _____

General Contractor_____ **Project Manager** _____

G.C. Contact Number_____ **Email** _____

Food Service Consultant Foodservice Design Professionals, LLC **Project Manager**_____

Contact Number 281.350.2323 **Email** _____

An on-site Inspection to verify the location of INSTALLED utilities was conducted on this date. The following conditions were observed and brought to the attention of the General Contractor. (KEC is to provide a written description and copy of the Utility Plan indicating the corrective action required).

1. What difficulties were encountered?

Inspector's Initials _____

This Inspection Report is the responsibility of the Kitchen Equipment Supplier and the General Contractor. Coordination between the two parties is mandatory.
Neither the Architect nor FDP need to be present at these inspections.

EMAIL A COPY OF THIS REPORT AND ANY ADDITIONAL INFORMATION TO THE ARCHITECT, GENERAL CONTRACTOR AND FOODSERVICE DESIGN PROFESSIONALS, LLC.

C. Review critical systems/components for application, performance, and capacity and submit calculation worksheets with the initial submission of brochure/rough-in drawings, with all proposed adjustments noted, including:

1. Exhaust hood removal/supply air volume, velocity, static pressure, duct collar sizes, and locations.

2. Refrigeration Systems (compressor, condenser, and evaporator) capacities/sizes, quantities, and refrigerant piping distances/sizes.

3. Exhaust Hood Fire Suppression Systems (nozzle locations, air handler, fuel interlocks, piping/distance limitations).

4. Locations of Vacuum Breakers.

5. Conformance of Refrigerated Components/Equipment with HACCP Guidelines (e.g., salad/sandwich pans, upright/open refrigerator cabinets, salad bars) with HACCP Guidelines.

6. Gas and water line sizes and manifold configurations.

7. Diameter and length of flexible connector lines for fixed/movable gas appliances.

8. Fabricated Equipment load center panels (individual and total amperage calculations and circuit balance).

9. ADA compliance of workstations, service positions, passageways, etc.

D. Ceiling mounted appliances/fixtures: Verify and coordinate dimensions/location of support framing/hangers with the General Contractor—all material and installation below 12’-0” AFF: Section 11 40 00.

E. Dimension Responsibility: Obtain actual or guaranteed measurements for the proper equipment fit. All dimensions indicated in Contract Documents are approximate and are as accurate as can be determined at the time. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment and notify the Architect of all conflicts or deviations from the dimensions shown.

F. Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for their correctness. No extras will be allowed for variations from drawings in existing conditions or work performed under this contract. Any discrepancies found shall be submitted to the Architect for instructions before proceeding.

G. Scheduling to Fit Openings: Should it become necessary to schedule the construction of walls or partitions before delivery of fixed equipment, the equipment must be fabricated for passage through finished openings. Maintain close contact with the project and be cognizant of all conditions, including vertical handling limitations within the building (elevator cabs or openings, stairs, etc.) and possible hoisting requirements. Coordinate all procedures with General Contractor and Project Team.

H. Refrigerated and Dry Storage Areas: Verify and coordinate dimensions to accommodate scheduled modular shelf sections. Notify Architect of the variance between the Contract Documents and actual conditions.

I. Color/Pattern Selections: Submit selection samples of solid polymer products, plastic laminate, paint or stain finishes, and vinyl-coated surface material of equipment as selected by the Owner.

J. Movable Equipment Interface: Rolling stock (pan racks, carts, dollies, dish/tray/rack dispensers) required to fit through or into fixed equipment (roll-in refrigerators, counter bodies, etc.) is to be reviewed and coordinated for compatibility at the time initial of shop drawing submittal. Indicate conflicts and proposed adjustments.

K. Relocation of Work: Relocate or re-route work as required to coordinate related items free of charge if no extra work is involved.

L. **Kitchen Equipment Contractor must provide FDP with the food service equipment lump sum pricing (including material and labor) after the contract has been executed and *before submittals* are provided to FDP. *This information is critical to FDP for accounting/billing purposes.***

1.12 EQUIPMENT FURNISHED / INSTALLED BY OTHERS

A. Obtain and coordinate utility requirements of Owner-Furnished/Owner-Installed (OF/OI) equipment with the building utilities and rough-in drawings/provisions.

B. Coordinate physical data of OF/OI appliances or equipment and incorporate information into Submittal Drawings. Vendor- or Purveyor-Furnished equipment (e.g., coffee/tea equipment): same as OF/OI.

1.13 WORK INSTALLED BUT FURNISHED BY OTHERS

A. Coordinate delivery/installation schedule of Owner-Furnished/Contractor-Installed (OF/CI) equipment with the Owner at least ninety (90) days before equipment requirement.

B. Obtain and coordinate utility requirements of OF/CI equipment with the building utilities and rough-in drawings/provisions.

C. Receive at the job site and fully incorporate into installation procedures as if furnished under this Section.

PART 2 - PRODUCTS

2.1 FABRICATED FIXTURES MATERIAL / COMPONENTS

A. Stainless steel sheets or shapes: 18-8, Type 302, polished to 180 grit No. 4 finish.

1. Stainless steel joints and seams: Heli-arc welded, free of pits and flaws, ground smooth, and polished to a No. 4 finish.

2. The “grain” direction of horizontal stainless-steel surfaces: Longitudinal, including the backsplash. The polishing procedure at right-angle corners of fixtures shall provide a mitered appearance.

B. Galvanized Iron Sheets: Armco copper bearing Zinc Grip or Zinc Grip/Paint Grip.

1. Galvanized iron joints and seams: Arc-welded, free of pits, flaws, and ground smooth.

2. Galvanized sheets or shapes: Washed with mineral spirits and painted with Rust-Oleum gray semi-gloss enamel.

C. Sound Deadening: Schnee Butyl Sealant ½" wide rope positioned continuously between all frame members or contact material and underside of stainless-steel surface (sinks, tabletops, food wells, over shelves, and undershelves). Tighten stud bolts for maximum compression of sealant and trim excess.

D. Plastic Laminates: Color/pattern selected by Architect, in 1/16" thickness for flat surfaces: 1/32" thickness for radiused surfaces. Plastic laminates and adhesives must be NSF-approved (Standard No. 35).

E. Solid Polymer products: Color/pattern/material selected by Architect in thickness as specified. Solid Polymers and adhesives must be N.S.F. approved (Standard No. 51).

F. Casters:

1. Fabricated fixtures with "Open Base" construction: Jarvis and Jarvis Model No. 5-405-113P-NSF swivel casters with grease seals on forks and wheels; Zerk fitting in swivel; two casters: Model No. E-75 Verti-Lock brakes. All casters: B-7" rolling bumpers with stainless steel top discs.

G. Cutting Boards: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated.

H. Identification Plates, Labels, Tags:

1. Prohibited Information: Names of suppliers, fabricators, and contractors.

2. NSF Labels: Required on all pieces of equipment.

3. Required Information: Function or purpose of controls such as display light switches, food warmer controls, etc.

4. Plate Construction: Engraved phenolic plastic, secured to equipment with epoxy cement or stainless-steel screws. Furnish samples.

2.2 PLUMBING / MECHANICAL REQUIREMENTS

A. Plumbing Fittings and Components: Furnished under this Section as follows:

Note: Fitting and components described in Items 1, 2, 3, 4, and 5 are furnished loose by 11 40 00 for final installation and connection by Division 22.

1. Control valves and appliance pressure regulators for water, gas, steam, and vacuum breakers: wherever required on food service equipment (chrome-plated where exposed).

2. Faucets and drains with and without connected overflows (unless otherwise indicated) for all sinks.

3. Specialty food service water-fill faucets, hose bibbs, or hose assemblies indicated in drawings/specifications.

4. Wade Model No. W-10 Shock-Stop shock absorbers for all food service equipment with quick-opening or solenoid-operated water valves.

5. Dormont Series Water Quick Disconnect hose, diameter per water connection size requirements, with safety fitting, w/coiled restraining device, full port ball valve, antimicrobial coating, lifetime warranty.

6. Extensions of indirect waste fittings to open-sight floor sink or floor drains from sinks, under bar equipment, and food-holding components of serving counters (e.g., cold pans, hot food wells, refrigerator/freezer coils not equipped with condensate evaporators) furnished and installed by Division 22. Drains: All drains to be type 'K' Copper – Paint with aluminum paint where exposed**. Div. 22 to ensure a minimum air gap of 1" and not less than twice the effective opening of the indirect waste pipe, per code. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.**

7. Piping brackets and supports beneath fabricated equipment.

8. Closed Base Bodies: Removable 18-gauge stainless steel closure panel at plumbing penetrations under the top.

9. Control valves on Open Base fixtures: Mounted on a 14-gauge stainless steel gusset-shaped panel with h 3½" setback from the countertop edge/rim to the face of the control handle.

10. Fill hose/faucet at support pedestals or Closed Base Body: Installed in a 15" x 18" x 5" deep recessed mounting panel. Panel bottom: sloped on a 60° angle, with 3/8" stainless steel rod hanger-bracket for the hose.

11. Provide filtration option as shown on contract documents (a, b, c, or combination thereof):

    a. In-line Water Filter System:

        i. Everpure System filters for coffee/tea brewers, icemakers, water chillers, convection steamers, and beverage systems. They should be sized per the manufacturer's recommendation.

    b. Remote Central Water Filter System.

    c. Remote and/or In-line Reverse Osmosis system.

B. Gas-Heated Equipment Fittings and Components: Furnished under this Section as follows:

1. Fixed Equipment: Dormont 1675KIT2S48 gas appliance connector: Diameter per fuel volume/connection size requirements. Gas valve diameter size per fuel volume/connection size requirements.

    a. Restraining device: Heavy duty steel cable, fastened to equipment and walls, 3" to 6" shorter than equipment connector length.

C. Final Plumbing Connections Provisions:

1. Fabricated equipment containing components, fittings, and devices indicated on food service connection drawings to be connected to the building systems: each component, fitting, or group thereof pre-piped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.

2. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, convection ovens, etc.): plumbing components completely interconnected under this Section for final connection arrangements indicated on Utility Connection Drawings.

3. All plumbing final connection points of equipment shall be tagged, indicating the following:

   a. Item number

   b. Name of devices or components

   c. Type of utility (water, gas, steam, drain, chilled water)

D. Ducts and Vents:

1. Exhaust hoods furred-in to ceiling: 2" high duct collar for final connection to the duct system.

2. Warewash machines equipped with integral vent cowls or extended hoods: furnished with 18-gauge stainless steel seamless duct risers to 6" above the finished ceiling for final connection. The duct: trimmed at the ceiling with a 16-gauge stainless steel angle flange with all corners welded.

E. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Sub Sections E. Plumbing and F. Mechanical for additional information.

2.3 FOOD SERVICE EQUIPMENT REFRIGERATION SYSTEMS

A. Install complete with all refrigerants, oil, dials, dehydrators, gauges, and controls required for the system's proper operation.

B. Self-contained or factory-installed compressors: Check and adjust to the proper operating temperature prescribed by FDA/HACCP.

2.4 PLUMBING TRIM

A. Faucets: Furnished for all sinks or equipment requiring open water supply.

B. Fill Faucets: Furnished for appliances requiring open water supply.

C. Drain Fittings: Furnished for all sinks or equipment requiring removal of liquids. Install specified chrome-plated or stainless-steel fittings in die-stamped openings with washers and locknuts. The solder may be used as a sealer but shall not be applied to the top surface of the drain fittings.

2.5 ELECTRICAL REQUIREMENTS

A. All electrical systems, components, and accessories within the work of this Section: Certified to be in accordance with NEC 70.

B. Electrical Fittings and Components: Furnished under this Section as follows. Coordinate food service equipment loads, voltage, and phase with the building system and confirm any existing or OF/OI equipment requirements.

C. Cord and Caps:

1. Coordinate all food service equipment cord/caps with related receptacles.

2. All 120, 120/208, and 208 volts “plug-in” equipment shall have Type SO or SJO cord and plug with ground wire fastened to the frame/body of the item.

3. Cord lengths for fixed equipment: Adjusted to eliminate loose-hanging excess.

4. All non-fixed plug-in “buy-out” equipment: Hubbell configuration and ratings as required.

5. All mobile electrical support equipment (heated cabinets, dish carts, etc.) and counter appliances mounted on mobile stands (mixers, food cutters, toasters, coffee makers, microwave ovens, etc.): 8’-0” cord length with cord-hanger strap secured to the rear of equipment or mobile stand.

D. Switches and Controls:

1. Each motor-driven appliance or electrically heated unit: Equipped with a control switch or starter per Underwriters’ Laboratories, Inc., with low-voltage and overload protection.

2. Disposer controls recess-mounted in the wall: External fittings and accessories removed from the enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 4’-0” AFF to the bottom of the enclosure.

3. Disposer controls recess-mounted in counter-splash risers: External fittings and accessories removed from NEMA 4 enclosure and furnished with 16-gauge stainless steel perimeter angle flange with welded corners. Install control at 3’-0” AFF to the bottom of the enclosure. Provide the panel with a 60” long Seal-Tite electrical conduit from the bottom of the control panel for final field connections under Division 26.

4. Equipment that is not provided with built-in circuit breakers or fused terminal block and is indicated on Utility Connections Drawings to be directly connected to the building electrical system: a NEMA 4 stainless steel disconnect switch furnished and installed by Division 26.

5. All remote manual starters, disconnect switches, magnetic contactors or starters, and push-button stations: NEMA Type 4 enclosure; NEMA Type 1 enclosure only when installed in a Closed Base Body.

E. Heating Elements:

1. Electrically heated equipment: Thermostatic controls.

2. Water heating equipment: Equipped with positive low water shut-off.

F. Receptacles and Switches:

1. Receptacles installed in vertical panels of support pedestals or Closed Base Bodies: installed in 12” x 8½” x 3” deep recessed mounting panel sloped at a 60° angle and turned up to the top of the opening.

2. Pre-wire receptacles in closed base fixtures to a junction box installed within 6” from the bottom of utility or compressor compartments.

3. Receptacles mounted on Open Base fixtures: Installed on a 12” x 10½” x 4½” deep 14-gauge stainless steel panel with returned ends and sloping recess—secure panel to the underframe of fixture top.

4. Pre-wire receptacles on open base fixtures to a junction box secured to a leg or mounted on the underside of the lower shelf. Vertical runs of wiring: Made in rigid conduit or within the tubular leg.

5. Receptacles installed in/on-fabricated equipment: Hubbell, Inc. assemblies horizontally mounted in a metal box with stainless steel cover plate.

6. Switches installed in/on-fabricated equipment: Hubbell, Inc. with metal box and stainless-steel cover plate. Switches: pre-wired to the controlled device and a junction box installed within 6” from the bottom of the utility or compressor compartment. All refrigeration system switches: Installed within the compressor compartment near the door opening.

7. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to the load center with balanced phase loading. Load center: Ready for final connection by Division 26 and flush-mounted within the utility compartment rear panel, set back 8” from the access door. All breaker/device information will be typewritten on the circuit schedule in the load center door (number corresponding breaker/device) with an enclosed schematic wiring diagram of fixture components.

8. All receptacles are to be pre-wired to the cord and plug assembly and routed through the over-shelf post at all island equipment locations unless specified otherwise.

G. Light Fixtures:

1. Light fixtures with lamps installed in/on fabricated or field-assembled equipment: pre-wired to a junction box for final connection (continuous-run fixtures when indicated).

2. LED Display Light: Install light fixtures full-length of Display Stand and Serving Shelf with stud bolts and pre-wire through support posts to an apron-mounted switch.

3. Heat Lamps: Installed to the underside of serving shelf assemblies. When multiple 24” heat lamps are specified, provide maximum length heat lamp chassis. Install all switches remotely from lamps.

4. **Walk-in assembly LED Light Fixtures: Furnished by Section 11 40 00, final installation by Div. 26. All electrical wiring and conduit, provided by Div. 26, electrically connected through the Vapor Proof light fixture base connection, located on the interior door header—all Conduit to be EMT Watertight. Door frame wiring stubs out the top of panels 8” in flexible conduit for final connection by the electrical contractor. All horizontal conduits: below ceiling panels. All lighting fixtures will be wired from inside the assembly—no penetrations through the ceiling panels. Seal-sleeved penetrations are airtight at both sides of the panel. KEC is responsible for verifying that trade contractors seal all penetrations.**

H. Final Electrical Connection Provisions:

1. Fabricated equipment containing electrically operated components or fittings indicated on Utility Connections Drawings: Direct connected, with each component, fitting, or group pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.

2. Fabricated equipment containing electrically operated components and devices indicated: Circuit-breaker load center with each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.

3. Field-assembled equipment (e.g., prefabricated walk-in assemblies, exhaust hoods, ware wash machines, etc.) shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connection Drawings by Division 26.

4. Pre-wire the following groups of walk-in assembly electrical devices to a top-mounted junction box for final connection by Division 26 per compartment grouping (unless otherwise indicated).

   a. Light fixtures and switches; heated pressure-relief ports.

   b. Door/jamb heaters.

   c. Evaporator fans, defrost elements and drain line heaters.

5. All electrical final connection points of equipment shall be tagged, indicating the following:

   a. Item number.

   b. Name of devices on the circuit.

   c. Total electrical load.

   d. Voltage and phase.

I. Lamps: in all food service equipment containing light fixtures. Refrigerator or heated cabinets: All exposed LED lamps above or within a food zone: Shat-R-Shield lamps or standard lamps, sleeved with end caps.

J. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection F. Division 26 (Electrical) for additional information.

2.6 CUSTOM – FABRICATED / ASSEMBLED UNITS

A. Mechanical or electrical operating components or products integrated into a fabricated fixture: Ventilation and service access required or recommended by the manufacturer. The size and placement of the service access panel(s) permit easy lubrication, adjustment, or replacement of all moving parts and are to be indicated on fabrication shop drawings.

2.7 BAKER TABLETOPS (Unless specified otherwise)

A. 14-gauge 304 S/S top with 2” square turn down at the front, 6” high enclosed splash at two (2) sides and rear. Brace same as “Counter/Tabletops.”

B. 1¼” x 6” high integral coved riser at rear and ends unless indicated otherwise on drawings.

C. 16-gauge stainless steel flour-trough at free long sides, secured to the underside of the top. Trough: 3” diameter with eased edges/corners.

2.8 COUNTER / TABLETOPS

A. 14-gauge stainless steel; all free edges turned down 2" with ¾" tight hem at the bottom—free corners: rounded on ¾" radius.

B. Marine edges: Turned up ½" on 45º angle and turned down 2" with ¾" tight hem at the bottom.

C. Cafeteria serving countertops at hot food stations: Full-length x 3½" x ½" high raised rail at (customer's) front side with 45º integral turndown to counter surface.

D. Tops abutting high fixtures or walls: Cove up specified height and slope back 1½" at the top on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of the splash and tight ends to the bottom of the top turndown. Secure splash turndown to the wall with a 4" long 14-gauge stainless steel "Z" clip anchored to the wall, 36" OC.

E. Freestanding tables and all serving counter splash-risers: Turned back at a 90º angle with 1" turndown at the rear.

F. Brace tops with rigid-welded 1½" x 1½" x 1/8" galvanized steel angle frame at the perimeter with cross bracing 2'-0" OC maximum. Provide 4" x 4" x 12-gauge stainless steel triangular pads where leg gusset welds to frame. Paint the entire frame with Rust-Oleum gray semi-gloss enamel. Angle frames: Secured to the underside of top surfaces with ¼" studs welded 9" OC maximum with chrome-plated washer, lock washer, and cap nut. Studs: Such length that cap nuts can be made up tight, bringing the top down snugly on the angle frame, eliminating all vibrations or "oil-canning."

G. Tops: 1½" overhang at free sides of underframe or Closed Base Body.

H. Mockett Model No. SG5-26 chrome-plated/plastic grommet assembly or integrally welded stainless-steel flange or inverted gusset where service utilities or support posts penetrate or abut tops, ground, and polished to match the top. When conditions permit, provide a 1" x 1½" rectangular backsplash opening for service utilities instead of piercing the horizontal surface. Install stainless steel split tubing at the raw edge of the opening.

I. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.

J. All openings in tops: 3/16" high raised die-formed edges.

K. All top openings for pans or inserts: 20-gauge stainless steel, watertight liners, 8½" deep, secured to the underside of the countertop.

L. All "built-in" and "drop-in" counter equipment/appliances to have framing members at the perimeter of the opening.

M. Scrap Basket: 18-gauge stainless steel construction 6½" x 6½" x 21¾" long. Top of container: 5/8" wide x ¼" high full perimeter flange with ¼" diameter stainless steel rod bail handle. Interior vertical corners coved on ½" radius. Countertop: Fitted with 6¾" square die-stamped opening.

2.9 COLD PANS

A. 14-gauge stainless steel with ¾" coved interior welded integrally to the countertop with a 3/16" raised edge at the perimeter of the opening – depth of cold pan to follow NSF 7 compliance.

B. Slope bottom to required quantity of Component Hardware Model No. E16-4021 drain fittings at 48" OC maximum. Sleeve through insulation at drain fittings and extend common drain line into utility compartment for indirect waste connection.

C. ½" OD copper refrigerant lines in a serpentine pattern, 1½" OC flattened for maximum contact. Secure tubing to the underside of ¼" thick aluminum "distribution plate" installed tight to the underside of the frost plate area and apply cold-conductive mastic to all surfaces.

D. Component Hardware Model No. E16-4021 drain fittings at 48" OC maximum, sleeved through the insulation with common drain line extended into utility compartment.

E. Heat Cable: Low-wattage, full-perimeter, below countertop at the edge of depression. Secure with "Z" clips, 9" OC, and interwire with compressor switch for simultaneous operation.

F. Enclose the sides and bottom of pans with an airtight 18-gauge galvanized jacket and pack with 2" fiberglass insulation set in mastic.

G. Compressor: Size as indicated or required to accommodate the size of the cold pan. Locate the compressor in the compartment below the unit or as shown on the drawings.

H. Sectional 16-gauge stainless steel perforated false bottom (¼" holes, @ ¾" OC). Turn down 1½" on all sides, weld corners, and provide finger rings. False bottom sections: 24" long maximum.

2.10 DRAWERS

A. Stainless Steel Liners: Component Hardware Model No. S81-2020C (20" x 20"), easily removable with drawer in the fully extended position.

B. Drawer Frame: 16-gauge stainless steel flanged out at the top. Weld the frame to a double-panel 16-gauge stainless steel drawer front with full-length recessed pull at the top (similar profile as Garcy Model No. R-1060) with closed ends.

C. Channel-formed horizontal pull: ¾" turndown at the front and ends with ½" tight hem. The front edge of the pull: flush with the face of the drawer. Recess behind pull: sloped up on a 60° angle, terminating 1" below the bottom edge of pull.

D. Mount drawer frame on Component Hardware Model No. S52-2020 self-closing slides, with Delrin bearings, full-depth of the fixture. Secure slides to the body or brackets to eliminate lateral movement in the extended position. Refrigerator drawers: Component Hardware Model No. S52-2024 stainless steel slides with Delrin bearings.

E. Drawer enclosure in an Open Base Fixture: 18-gauge stainless steel flanged out at the top for attachment to the underside of the tabletop. The lower edge of the enclosure is flanged in toward the open bottom. Mount drawer slides to enclosure and brace as required. The face of the enclosure is to be the same length and height of the drawer face. Provide ¾" deep offset in front of the enclosure and 2½" from the underside of the tabletop for a flush-fitting appearance.

F. Drawer enclosure on freestanding fixture: Full depth of table framing.

G. Drawer enclosure in a Closed Base Fixture: Completely partitioned from the adjoining area. Drawer front: Flush fitting with the face of the body.

H. Drawer Liners other than tool/utility: **Bread Drawer:** S/S liner sized to fit drawer; **Refrigerated Drawer:** S/S liner sized to fit drawer.

I. Cash Drawer: Integral stainless-steel body, 3" deep.

2.11 FOOD WELLS (UNLESS SPECIFIED OTHERWISE)

A. Food Warmer Controls: Remote-mounted in sloping recessed apron panel. The control panel is recessed 2½" from the bodyline at the top of the 60° slope and 1" at the lower edge. Terminate slope angle 2½" below the countertop. Mount panel on concealed piano hinge at bottom edge; secure with screws at upper corners.

B. Manifold all warmer drains and extend to within the utility compartment for indirect waste connection. Install valve in the drain line and extend handle through compartment door.

C. Removable 18-gauge stainless steel closure panel at the underside of warmers.

D. 14-gauge stainless steel plate/utensil shelf full-length of hot food station unless noted otherwise: 10" below countertop x 9" deep, with rear panel coved up to the underside of the countertop; end panels turned up square. Front of shelf: Turned down 1½" and returned under for closure panel attachment.

E. Food wells: Hatco Model No. HWBIBRT-FULD insulated food warmer (1200 watts, 208 volts, single phase) secured to the underside of 12" x 20" die-stamped countertop openings with thermal breaker mastic rope applied at the perimeter of food well flange.

F. Soup Warmers: Hatco Model No. HWB-11QTD soup warmer secured to the underside of 11" diameter die stamped countertop opening with thermal breaker mastic rope applied at the perimeter of soup well flange. The maximum allowable temperature of the countertop at the contact surface is: 120°F. Each warmer: Equipped with one 11-quart stainless steel round insert and slotted cover.

2.12 SINKS

A. 14-gauge stainless steel; all interior corners (horizontal/vertical) coved on ¾" radius. 1½" wide double-walled partitions with flat tops between compartments.

B. Continuous exterior panels of multiple-compartment sinks: 14-gauge stainless steel filler panel welded ground and polished between compartments.

C. Sinks (with overflow): Score and slope sink bottom ½" to die-stamped opening fitted with Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. 14-gauge stainless steel bracket: Welded to sink bottom for drain stem with 1½" handle clearance.

D. Where sinks are installed in fixtures with Closed Base Body, provide a Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. (Sinks with dimensions larger than 20" x 20" in Closed Base Body will not have overflow fitting.) 14-gauge stainless steel bracket: welded to sink bottom with T & S Model No. BL-4740-1 guide bushing. Install on shortened drain stem, one T & S Model No. BL-4710-1 remote control stem assembly only (length as required) with Model No. 113-L universal joint and white blank button. Set drain control handle in Cambro Model PSB-6 bowl with bottom omitted (dress raw edge) to permit passage of drain handle—secure bowl in utility compartment door or body panel with clear silicone.

E. When single-hole deck-mounted faucets are specified, install overflow fitting in the sidewall of the sink compartment and provide ell-fitting in connecting tubing.

F. Flush Covers when specified: 1/2" thick Read Products, Inc. "Richlite" cutting board, size as indicated. Support clips: ¼" stainless steel rod 2" long, formed at 45º with two ¾" leg ends (¼" long threaded ends). Insert rod clips through tight-clearance holes in the sink, seal watertight, and secure with stainless steel acorn nuts or tack-weld at the exterior of the sink wall. Set support clips ½" below the top. Provide a 14-gauge stainless steel channel or angle support frame to store covers when not in use. Cover holder: Adjacent to sink compartment, below countertop, or under drawer assembly.

2.13 TRAY SLIDES (UNLESS OTHERWISE SPECIFIED)

A. Tray slides: 12" wide, solid 14-gauge stainless steel turned up 2" at the rear behind countertop turndown; turned down 4" at the front and free ends unless otherwise indicated.

B. Three ¼" high die-formed inverted "V" ridges at 4" OC, 2" from the leading edge, terminating 2" from ends of tray slide with tapered ridge ends.

C. Ridges formed on radius: Equal-length segments with 2" separation between chords.

D. Secure tray slides to countertop/body frame, same as "Countertops." Enclose the exposed underside of the tray slide with 18-gauge stainless steel.

E. When indicated, project tray slides 2" beyond the serving countertop and return the entire width of the serving counter at free ends.

F. All tray slides are to be provided and mounted per ADA requirements.

2.14 DISHTABLES

A. Soiled/clean dishtable: 14-gauge stainless steel; free edges coved up 3" with 1½" diameter rolled rim and bullnose corners.

B. Edge of dishtables next to high fixtures or walls: Coved up 10" and sloped back 1½" on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of splash and secure to wall with 4" long 14-gauge stainless steel "Z" clips anchored to the wall, @ 36" OC.

C. Exposed rear splash: 16-gauge stainless steel finish panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end. Secure the panel with concealed attachment and install bracing 24" OC.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot to sinks, scuppers, or ware wash machines, maintaining level crown/splash.

E. Brace dishtables with 1" x 4" 12-gauge stainless steel channels down the top centerline and between each pair of legs, with closed ends. Bracing: secured to the underside of the dishtable with ¼" studs welded 6" OC maximum, with chrome-plated washer, lock washer, and cap nut. Studs: such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and "oil-canning."

F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops; ground and polished to match the top.

G. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8" stainless steel rod hose hanger.

H. Extend underbracing members to the wall, turn down 6", and anchor to the wall when specified to be mounted on leg/bracket assembly.

I. Paper-Drop Opening: 9" square with 4" integral chute having hemmed bottom edge. Slope dishtable top 1" toward the opening, forming a 16" square tapered deposit point.

J. Accessible Tray-Drop Opening: 10" x 18" with integral 16-gauge stainless steel seamless chute sloped at 45º angle toward the center of mobile soak sink position.

K. All dishtables with a Conveyor Type Dishmachine must have a table limit switch provided by Manufacturer and installed by Division 26. Wiring must be concealed within dishtable fabrication.

2.15 DISH / TRAY DEPOSIT ASSEMBLY

A. 14-gauge stainless steel deposit shelf, size as indicated. Extend the frame through the opening, flush with the public side of the partition, height as local code authorities require. Turn the shelf down 1" at the front with ¾" return at the bottom (either scribed into a partition or forming reveal). Shelf: 1" square turndown at the long rear side, integral with conveyor slider pan, tray-accumulator, or dishtable. Extend the rear/end splash to align with the head of the deposit station opening. Modify rolled rim at the operator's side of the tray drop window to have a 3" rolled rim.

B. 18-gauge stainless steel window frame with perimeter flange channel-formed 1" x ¾" at both wall sides. Weld all corners of the frame and install with concealed attachment. Align/abut one jamb of the frame with end splash of conveyor slider pan or dishtable whenever adjacent.

2.16 UTENSIL – WASH COUNTERS

A. 14-gauge stainless steel; all free edges coved up 3" with 1½" diameter rolled rim and bullnose corners.

B. Edges of utensil-wash counters next to high fixtures or walls: Coved up 10" and sloped back 1½" on 45º angle; 2½" slope where piping occurs. Turn down 1" at the rear of splash and secure backsplash to the wall with 4" long 14-gauge stainless steel "Z" clip anchored to wall @ 36" OC. Vacuum breaker pockets: 4" long square turnback sections aligned with the slope break line.

C. Exposed Rear Splash: 16-gauge stainless steel finished panel from the top of the splash to the bottom edge of the rolled rim with a welded vertical joint at the end of the splash and ½" turnback at the bottom of the panel. Secure the panel with concealed attachment and install bracing 24" OC.

D. Cove all interior corners (horizontal/vertical) on ¾" radius and slope tables 1/8" per foot, maintaining level crown.

E. Brace utensil-wash counters with 1" x 4" 12-gauge stainless steel channels down the centerline of the top and between each pair of legs, with closed ends. Bracing: Secured to underside of dishtable with ¼" studs welded 6" OC. maximum, with a chrome-plated washer,

lock washer, and cap nut. Studs: Such length that the cap nuts can be made up tight, bringing the dishtable down on the channel members, eliminating all vibration and “oil-canning.”

F. Integrally welded stainless steel flange or inverted gusset where service utilities or support posts penetrate or abut tops: ground and polished to match the top.

G. Extend underbracing members to the wall, turn down 6”, and anchor to the wall when specified to be mounted on a leg/bracket assembly.

H. Hose Bibb: Chicago Model No. 305VBRCF; mounted on 12-gauge stainless steel flange or inverted gusset bracket with 3/8” stainless steel rod hose hanger.

2.17 DOORS

A. 18-gauge x 1” stainless steel double pan-formed welded construction, insulated with 1” thick polyurethane boards. Seal the perimeter joint of the pans. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the Body.

B. Channel-formed full-length horizontal recessed pull: ¾” turndown at the front and ends with ½” tight hem. The front edge of the pull: Flush with the face of the door. Recess behind pull: Sloped up on a 60° angle and terminated 1” below the bottom edge of pull.

C. Door Hardware

1. Two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge location).

2. Component Hardware Model No. 35-2000 Concealed Magnetic Catch.

3. Component Hardware Model No. D30-4780 lock in the upper free corner of the door.

D. Louvered opening: Cut-out opening size as indicated, turn in 1”, and weld. All corners: Ground and polished.

1. Full-height 18-gauge stainless steel louver with 1” vanes at 45º, ½” spacing. Perimeter channel-formed frame: 1½” x 1”.

2. 45º x 1” x ½” x opening width plus ½” 18-gauge stainless steel louver.

3. Tack the louver flange's weld tab to the door's back panel.

E. Drain handles opening: 6” diameter hole through the double pan to accommodate Cambro Model No. PSB-6 Bowl:

1. Secure the bowl to the door panel with clear silicone.

2. Omit the bottom of the bowl. Dress raw edges of opening for passage of drain handle.

3. Exposed insulation at the penetration of the door pan: Painted black.

F. Sliding Doors: fabricate same as Paragraph “A.”

1. Aluminum Sliding Door Track: Component Hardware Model No. B57-0000 Series, length as required. Secure to angle frame at the top of the underside.

2. Front/rear door sheaves: Stainless steel ¾" side-mounted door hangers; two (2) required per door.

3. Recessed Vertical Pull at Upper Corner of Door: Component Hardware Model No. P63-1012.

4. By-Passing Door Guides secured to bottom shelf: Component Hardware Model No. B62-1093.

5. Door Stop at the bottom edge of door: Component Hardware Model No. B60-1086.

G. Offset the lower horizontal framing member of the Closed Base Body/utility compressor compartment to align the door flush with the bottom of the Body.

2.18 CLOSED BASE BODIES

A. Frame: Rigid-welded 1½" x 1½" x 1/8" galvanized steel angle forming a continuous structure around the top and bottom perimeters of the fixture, a post at each corner, studs spaced 48" OC maximum. The top of the frame is cross-braced with 1½" angles, 2'-0" OC maximum.

B. 18-gauge stainless steel panels and trim with concealed attachment. All seams: Welded, ground, and polished.

C. Exposed Vertical Corners: Rounded on ¾" radius. Closed Base Bodies adjacent to walls or fixtures: square corners.

D. Vertical and horizontal channel members at shelf interior or drawer enclosures, such as corners and center mullions: Closed and sealed.

E. Closed Base Bodies set on finished masonry platforms: closed and caulked at the underside of equipment overhang and bolted to the platform. Body overhang of the platform: 1" at free ends and 2" at the front and exposed rear sides.

F. Closed Base Bodies not set on the platform: Component Hardware Model No. A54-2-6, 6" legs spaced 4'-0" OC maximum.

2.19 COMPRESSOR COMPARTMENTS

A. Same material as Closed Base Bodies with back and end partitions; omit bottoms only.

B. 10-gauge steel slide-out support: Channel frame on full extension slides with 125 lb. minimum capacity secured to fixture frame with anti-vibration mountings for maximum sound deadening. Closed Base Body on the solid platform: front-to-back slide-out support channels set 4" above the bottom for air circulation.

C. Access Door: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full length of the top (similar profile as Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turndown at front and face of the door. Recess behind pull slopes up on a 60° angle, terminating 1" below the bottom edge of pull. Offset the lower horizontal framing member of the Closed Base Body to align the flush access door with the bottom of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and Component Hardware Model No. 35-2000 concealed magnetic catch.

D. Access Doors Louver: Full-height, with 1½" x 1" x 18-gauge stainless steel channel-formed frame with welded corners. 18-gauge stainless steel louver. Submit a sample of the design for approval.

2.20 UTILITY COMPARTMENTS

A. Closed Base Bodies or Pedestal Supports: Fitted with utility compartments wherever piping or wiring is required in/on the fixture.

B. Same material as Closed Base Bodies with full-height back and end partitions. Omit bottoms except at hose-reel locations.

C. Access Doors: 18-gauge stainless steel double-pan type with a channel formed horizontal recessed pull full-length of the top (similar profile to Garcy Model No. R-1060) with closed ends. Channel-formed horizontal pull: ¾" turn down at the front of the door, a recess behind the pull slopes up on a 60° angle, terminating 1" below the bottom edge of the pull. Offset the lower horizontal framing member of the Closed Base Fixture to permit flush alignment of the door with the face and bottom edge of the body. Door hardware: two Component Hardware Model No. M75-1002 stainless steel hinges (notch door/jamb at hinge locations) and one Component Hardware Model No. 35-2000 concealed magnetic catch.

D. No shelves of Closed Base Fixtures are to be penetrated.

2.21 UTENSIL RACKS

A. Rack: ¼" x 2" 300 series stainless steel flat bar with No. 4 finish, fully welded and formed to match the shape shown on drawings. Lowest band - 7'-6" AFF unless otherwise indicated.

B. Ceiling Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing from band to 18" above the ceiling. Anti-sway bracing above the ceiling - 1½" Unistrut members. Tubing penetrations at the ceiling - Component Hardware Model No. A16-0206 stainless steel gussets.

C. Table Mount Supports 1-5/8" diameter 16-gauge stainless steel tubing extended through countertop. Secure to closed base framing or cross rail/undershelf on the open base fixture. Tubing penetrations of countertops - integrally welded stainless steel inverted gusset.

D. Utensil Rack Hooks - Component Hardware Model No. J77-4401 stainless steel hooks spaced 8" OC maximum.

E. Electrical Receptacle: NEMA No. 5-20-R or as noted. Mount in fully welded 3½" x 5½" x 3" 14-gauge stainless steel enclosure with ½" radius corners. Stainless steel cover plate to fit specified receptacle. Pre-wire through tubular support for final connection above the ceiling by Division 26.

2.22 CASHIER / SERVING COUNTERS

A. Exterior Body Panels, when specified: ¾" thick marine grade hardwood plywood with plastic laminate or solid polymer in Architect's selection of color/pattern at all exposed surfaces; backing sheet where concealed.

B. Position, size, and finish horizontal or vertical reveal as Architect directs.

C. Secure panels to counter body framing in a concealed manner. Install removable panels with “Z” clips overlapping body framing members.

D. Hinged doors in exterior body panel(s) - Grass Model No. 1200VZ or 1200VZ8 self-closing hinges. Three (3) required per door; Grass Model No. G/HRZ base plate at each hinge; Ives Model No. TM820 concealed push latch at each door. Confirm Model No. and provide samples with the submittal.

E. Cashier counter to have 16-gauge s/s intermediate shelf, turned down 1 1/2” with tight hem at front. Cove up 2” at rear and sides. Brace undershelf with 1” x 4” 14-gauge stainless steel channel at the longitudinal centerline. Provide an outlet for power/data within the body above the intermediate shelf. Provide cash drawer inserts per district standards.

F. Sneeze Guards to be adjustable and meet NSF standards.

2.23 OPEN BASE STRUCTURES

A. 1-5/8” OD x 16-gauge seamless stainless-steel tubing legs bevelled at the bottom. 1¼” OD cross rails fully welded (360° smooth and polished) to legs at 10” AFF, OC.

B. Top of Leg: Inserted in Component Hardware Model No. A20-0206 gusset fully welded to table frame or sink bottom.

C. Bullet Foot: Component Hardware Model No. A10-0851.

D. Freestanding fixtures requiring utility connections: Component Hardware Model No. A10-0854 flanged feet at the fixture corners, anchored to the floor with non-corrosive bolts.

E. Table Bases: Maximum leg spacing of 6’-0” OC; dishtable and utensil wash counter bases at 5’-0” OC.

F. Open Base equipment specified to be supported by brackets at the rear side only (not completely cantilevered): Tubular legs at the front side only with Component Hardware Model No. A10-0854 flanged feet anchored to the floor with non-corrosive bolts. Front-to-back cross rail: fitted into Component Hardware Model No. A20-0406 circular gusset secured to the wall with non-corrosive bolts.

2.24 UNDER SHELVES

A. Open Base Structures: 16-gauge stainless steel turned down 1½” with tight hem at the bottom. Notch all corners to fit tubular legs and weld from the underside to fill the gap, grind, and polish. Cove up 2” at the rear or ends adjacent to wall, columns, refrigerators, etc. The turn-up at freestanding fixtures is to be hemmed tight to the bottom of the turndown. Brace undershelf with 1” x 4” 14-gauge stainless steel channel at the longitudinal centerline and each intermediate pair of legs.

B. Open Base Structure specified to be supported by brackets at the rear side only (not completely cantilevered): 16-gauge stainless steel turned down 1 ½” at free sides with tight hem at the bottom edge. Notch all corners to fit tubular legs as required and weld from the underside to fill the gap, grind, and polish. Cove up 2” at rear ends, as indicated. Fill the gap at the front-to-back rail, grind, and polish. Brace undershelf with 1” x 4” x 1” 14-gauge stainless steel channel at longitudinal centerline between front to back rails.

C. Closed Base Fixtures: 16-gauge stainless steel turned down 1½" at front. Front edge of bottom shelf: Turned back and sealed to finished masonry platform or boxed for leg application. Center shelf has ¾" tight hem.

1. Shelves: Turn up square at ends (coved up at rear only) to the shelf above or countertop flanged out for attachment with no open spaces at interior.

2. All shelf partitions at exposed ends of cabinet bodies or interiors: Free of exposed framing members.

3. Reinforce shelves with full-length 1" x 4" x 14-gauge stainless steel closed hat channel.

4. Unless otherwise noted, all closed base undershelves must be 22" deep and clear.

5. Fully weld smooth and polish the vertical seam of the shelf turndown/turn up with the face of the body partition.

6. Seal the vertical seam of the square turn-in at the exposed interior of open shelf sections.

2.25 ANCHOR PLATES / WOOD GROUNDS

A. Behind the finished surface, wherever building walls, partitions, or ceiling construction will not accommodate direct attachment of equipment such as over shelves, wall cabinets, hose reels, utensil racks, exhaust hoods, display cases, etc. Material and installation by General Contractor. Location and coordination with trades by Section 11 40 00.

B. Anchor Plates: Not less than 12" x 12" x ¼" thick steel, secured to the structure above or behind the finished surface, positioned at attachment points.

C. Wood Grounds: Length required by fixture, component, or device, 24" wide x ¾" thick plywood secured to partition system before gypsum board installation.

D. Above ceiling supports: Structural shapes (4" x 8.0 lb. channel) suspended from the structure. Maximum height 15'-0" AFF. Size: width of equipment x length of equipment plus 6'-0". Cross bracing at 6'-0" OC maximum.

2.26 OVER SHELVES

A. 16-gauge stainless steel with free edges turned down 1" with ½" tight hem at the bottom—¾" radius at free corners.

B. Turn up 2" raw at walls and sides with a horizontal coved corner at the rear. Round front corners of turn up on ¾" radius.

C. Where shelf width exceeds 12" width, reinforce with ½" x 4" x 14-gauge stainless steel closed hat channel full-length of the shelf.

D. Wall-Mounted Shelves: 16-gauge stainless steel brackets 48" OC maximum, set in 6" from ends.

E. Freestanding Shelves: Where splash is required at free over shelves, turn up square 2" at ends, cove up at the rear, and hem tight to lower edge of front turndown. Weld exposed corners.

1. Freestanding over shelves: 16-gauge stainless steel cantilevered brackets at the rear of the table; double-cantilevered brackets at the center of the table. Posts for cantilevered over shelves are 1-5/8" OD x 16-gauge stainless steel secured to the underframe, 4'-0" OC. Ends of shelves: Secured to adjacent wall/fixture or mounted on 1¼" diameter stainless steel posts.

2. Freestanding over shelves not on cantilevered brackets: 1¼" OD x 16-gauge stainless steel posts, each pair at 4'-0" OC maximum.

F. Baker Table Over shelves: Supported 18" above the top with 1¼" OD stainless steel tubular supports with channel shoe secured to risers.

G. Glass/Cup Rack Over shelf at Dishtables: 14-gauge stainless steel with 1½" deep "vee" trough at free long sides with 1" tight hem inside the trough. Provide a ½" marine edge at free ends and; a 4" splash at the wall. Suspend shelf at 18" above dishtable surface on posts/brackets anchored to dishtable frame/wall at rear; 1" OD stainless steel tubing supports from the structure above the ceiling at front edge, 60" OC at each end.

1. Install at both ends a ½" stainless steel drain tube (connecting both vee-troughs) extended to the dishtable surface through splash turnback.

2. Rack-rest: horizontal full-length 1-5/8" OD stainless steel tubing supported at 10" OC above shelf (8" OC for double service shelf) by 1¼" OD stainless steel tubing with closed ends. Support tubing: welded, ground, and polished, spaced 60" OC.

3. Rack-rest supports to wall: 4" x 4" x 10-gauge stainless steel flange plates welded to support tubing. Anchor flanged plates to blocking ground with non-corrosive bolts.

2.27 DRAIN TRENCH LINER / GRATING

A. Liners: 14-gauge stainless steel in sizes as indicated.

B. Interior of liners: 6" deep with all interior corners (horizontal/vertical) coved on ¾" radius; sloped and scored 1" to integrally welded Component Hardware Model No. D34-Y011 basket drain assemblies @ 48" OC, fitted with 6" long welded tailpiece. Stainless steel safety chain: connected to basket strainer assembly and top of liner wall.

C. Liners: 1" wide perimeter shoulder at the top, turned up flush with finished floor, tight hemmed back down to the shoulder level, and flanged out 2" for attachment to the slab.

D. Underside of sloping liner portion: 2" long "Z" clips.

E. Grating: IMC-TEDDY PFD-ADA removable fiberglass grating:

1. 1" deep "I" bearing bars with 0.6" wide top flange.

2. Full perimeter frame, section quantities, and sizes indicated.

3. Maximum of 2'-0" sections.

4. Grating bars should be spaced 0.4" apart per ADA requirements.

5. Grating to be two (2) equal sizes.

2.28 WALL PANELS

A. Wall Panels: 18-gauge stainless steel, double pan-formed ½" thick with internal stiffener members. Fill with USDA-approved thermal insulation, full height, and width of panels, and attach to the interior with mastic. The maximum allowable temperature at the rear side of the panel: is 120°F.

1. Height of panels as required: Top of tile base to the underside of the hood, top of tile base to the top cap of stub wall, or top of splash to the underside of the hood.

2. Level and square lower edge and sides.

3. Butt joints on all panels.

2.29 EXHAUST HOODS (SURFACE-MOUNTED CONDENSATE)

A. Hoods: Size/shape as indicated: 18" high on the interior.

B. Body: 16-gauge stainless steel, with all seams welded, ground, and polished.

C. Continuous condensate trough at perimeter: 3" x 1".

D. Frame the top of the hood with 1½" angle iron assembly and suspend from the structure above the ceiling by ½" diameter steel rods, drawn tight against the finished ceiling surface.

E. Duct opening/collar as specified with stainless steel louvered grille over the opening.

F. Div. 22 to extend drain line to floor sink when shown. The drain line is to be silver painted. Div. 22 to ensure all drain lines are centered over floor sink grate openings and no water splashes on the floor.

G. ½" diameter steel hanger rods at 4'-0" OC maximum to be by Kitchen Equipment Contractor, but they are to be anchored to the supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.

H. Hoods and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements.

2.30 EXHAUST HOODS (UNLESS SPECIFIED OTHERWISE)

A. Exhaust to be provided to meet all current local jurisdiction mechanical and energy code requirements. Kitchen Equipment Contractor to verify code requirements and coordinate with Divisions 23 and 26. Hoods over production equipment to be Type 1 with continuous capture. All Type 1 hoods should be 6' deep to ensure smoke/steam capture unless otherwise noted.

B. Install fire suppression system(s) in all ventilators specified in this section. Install per the manufacturer's recommendations and applicable codes or standards. Submit installation certification form to Architect.

C. Locate chemical cylinders as indicated on drawings and install piping to exhaust hood(s) in a concealed manner. Set cylinders and cabinets at 7'-0" clear AFF unless noted otherwise. Provide polished chrome plated tubing piping/fittings, where exposed at cylinder location and at the interior of exhaust ventilator—exposed pipe threads in/above the food zone are not

allowed. Submit a schematic installation diagram and confirm critical distances from cylinders to nozzles.

D. Remote manual release located in the path of egress from the protected exhaust hood area. Kitchen Equipment Contractor to coordinate location with local Fire Marshal requirements before submittal review. All conduits will be recessed within the wall; SURFACE MOUNTING WILL NOT BE ACCEPTED.

E. Provide one (1) handheld Type 'K' and ABC 6-liter fire extinguisher per Ansul system, surface wall mounted.

F. Required quantity and sizes of mechanically operated gas valves.

G. Confirm interconnection of all equipment as required to ensure exhaust hood and fire suppression systems are entirely operational and meet local jurisdiction code requirements.

H. ½" diameter steel hanger rods at 4'-0" OC maximum to be by Kitchen Equipment Contractor, but they are to be anchored to the supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.

I. Provide an appropriate quantity of fire suppression systems as required by local jurisdiction code requirements.

J. Double wall insulated construction at ends. S/S where exposed.

K. Hoods and components to meet all NSF standards, NFPA 96, UL 710 and current IECC requirements.

L. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsection E. Division 23 (Mechanical) for additional information.

2.31 HIGHLIGHTING

A. Polish the following vertical surfaces to a No. 8 finish:

1. Serving and display shelf turndowns.

2. Conveyor and dish/tray deposit station turndowns/frame.

3. Tray slide turndowns.

2.32 SHOP / FIELD JOINTS

A. Field joints: The least number is used only when equipment size must be limited for building or interior space access.

B. Stainless steel tops (including edges and splashes): Fully welded, ground, and polished to match adjacent surfaces.

C. Vertical field joints of fixture backsplashes that are inaccessible from the back: terminate 1" above the horizontal coved corner. The remaining height of the field joint: hairline butt joint with offset draw-angle behind. All horizontal/vertical draw joints: located and noted on shop drawings.

D. Hairline butt joint: 1½" x 1½" x 1/8" steel angles welded to the back/underside of countertop/shelf. Offset angle beyond joining metal edge ½" (min.) to provide a flat backing surface for a joint with the angle of other joining metal edge, set for ½" space between vertical legs of angles. Bolt sections together with 5/16" machine bolts, lock washers, acorn head cap nuts, set 3" OC.

E. Closed Base Bodies: Draw-type with hairline seam fully field-welded.

F. Millwork: Plastic laminated joints shall be dowelled, glued, and draw-bolted with fasteners.

G. Solid Polymer: Surfaces drawn tight, filled, sanded, and finished to match adjacent surfaces.

2.33 PREFABRICATED WALK-IN COLD STORAGE ASSEMBLIES

A. Assembly to be installed by Factory Authorized Installers only.

B. KEC to provide a 1-year walk-in assembly panel installation warranty. Panel installation warranty to cover labor and part replacement issues resulting from a failure to complete the following during installation:

1. Walk-in assembly panels to be installed square, plumb, and level.

2. To create a proper seal, ceiling panels must be installed flush and tight to wall panels with undamaged gasket material. Any signs of condensation at joints or assembly wall panels should be reported to FDP and addressed immediately. Caulk at panel seams will not be an acceptable solution.

3. All cam-locks should be engaged and cam-lock covers in place.

4. Any gaps under the floor angle (due to shimming) must be entirely sealed to the slab.

5. All penetrations in the ceiling or wall panels should be insulated and sealed by appropriate trade contractors and verified by KEC, including but not limited to Light Fixtures, Refrigeration Lines, Sprinklers, Temperature Sensors, etc.

6. Proper installation of the door systems should allow the door to self-close and seal around the perimeter of the door opening and at the floor threshold.

7. Final operation of the IC/IC+ control, door heaters, and light switches should be confirmed upon completion of the electrical connections.

8. The walk-in assembly panel installation warranty will cover service issues resulting from faulty installation.

C. **KEC is responsible for overall install accuracy/quality and quality control of work performed regardless of installer or any field modifications due to building/construction conditions. KEC is to provide a Letter of Install Approval to Foodservice Design Professionals (FDP) upon completed installation, verifying that all items above have been inspected by the KEC for completeness and installed per manufacturer requirements. This letter will be required as part of the completion of the contract.**

D. Sectional Assemblies: Size/shape indicated on drawings; 9'-6" interior clearance unless otherwise specified. Door locations/size: exactly as shown.

E. Sandwich Panel Insulation: Class 1 Urethane with a vapor barrier, 4" thickness (unless specified otherwise) with mature "U" factor of .030 or lower. Finished panels shall be UL-listed and demonstrate a flame spread rating of 20 or less. Panels must meet performance standards as outlined in U.S. Government legislation.

F. Wherever compartment dimension exceeds the clear-span ability of ceiling panels, provide I-beam support on the exterior of the ceiling or spline-hangers. Install ½" diameter steel rods through beams/hangers and secure them to the structure above. Beams or posts within compartments are not acceptable.

G. Reinforce prefabricated wall panels to rigidly support the door assemblies. The perimeter of the door and frame shall be built of a fiberglass reinforced polymer (FRP) pultrusion. All pultrusion's shall be non-conductive, non-corrosive, rust proof and NSF listed. All doors shall be furnished with a replaceable aluminum braided heater wire, electronically monitored, and controlled as to initiation temperature, termination temperature and percentage of operation time as required. Install 2" x 4" 16-gauge stainless steel hat-channel full-width of the jamb with 1/8" stainless steel removable flush sill, secured with stainless steel screws and sealed watertight to channel.

H. Reinforcement as required to be provided above Freezer door (exterior) and panel next to door (handle side – interior) for mounting of Emergency Strobe Beacon, Push Button Panic Alarm and Release Knob. Emergency Strobe Beacons are by Division 26.

I. Provide an aluminum cove base at the interior and exterior of exposed panels for all floor assemblies.

J. Floor Installations:

1. **4" Recessed Exposed Factory Floor Installation (if required):**

   a. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.

   b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.

   c. 4" commercial grade manufacturer's dura floor with diamond treadplate surface and marine grade plywood subfloor.

   d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.

   e. 1/2" sand leveling bed by G.C.

2. **8-1/2" Recessed Floor Installation (if required):**

   a. Factory floor in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.

   b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.

   c. 4" manufacturer's floor.

   d. 15# felt slip sheet over insulation with 6" lapped joints flashed up the height of the finished floor base.

e. 1/2” sand leveling bed by G.C.

f. Concrete flooring and tile over insulation by Divisions 03/09.

3. **12” Recessed Floor Installation (if required):**

a. 6 mil polyethylene sheets in slab recess with all joints lapped 6 inches and sealed to form a watertight seal.

b. Level and square prefabricated perimeter and partition wall panels anchored to slab recess. Protect the exposed surface of panels.

c. 4” manufacturer’s floor.

d. 15# felt slip sheet over insulation with 6” lapped joints flashed up the height of the finished floor base.

e. 1/2” sand leveling bed by G.C.

f. Concrete flooring over insulation by Division 03:

i. Concrete mix: 5000 psi @ Freezers and 3000 psi @ Coolers.

ii. No limestone or fly ash; fiberglass reinforced.

iii. #3 rebar, set on 12” centers in both directions.

iv. Center rebar vertically in wearing bed.

v. 10” high concrete 45° angled wall curb at interior perimeter per food service details.

g. Diamond treadplate wall panels on the interior and exposed exterior by 11 40 00. Refer to drawings for height. Coordinate diamond treadplate wall covering at the interior with angled wall curb.

h. Ventilation Pipe Requirements by G.C.:

i. Bottom perforated vent pipes to be #40 PVC on six ft. max centers open on both ends with the thermostatically controlled fan on (1) end and perforated mesh on the opposite end of the fan at the exterior of the building.

ii. Vent pipes are to be turned parallel with the exterior wall - 180°turn down.

iii. Vent pipe openings to be held at 24” above grade or roof per design.

iv. Fans to be Grainger Manufacturer and sized per airflow needs. Airflow is to be sized based on the length and number of bends.

v. If no exterior wall is adjacent, vent pipes will route up and extend past the roof. Roof penetrations by Division 07.

4. **Surface Mounted Factory Floor Installation (if required):**

a. 4” commercial grade manufacturer’s dura floor with diamond treadplate surface and marine grade plywood subfloor.

b. 36” reinforced diamond treadplate internal ramp.

c. 10-gauge stainless steel threshold to provide a smooth transition to the interior walk-in assembly floor.

K. Integrated, flush-mounted temperature monitor/alarm with sensor and probe-cord length required to extend from the exterior front of the assembly to a mounting position of the sensor within the evaporator return airstream. System to have an easy-to-read LCD with high and low alarm set points with audible and visual alerts for alarm conditions. System to include Adaptive Programming for automatic set point control. Wi-Fi connectivity is included for remote notifications of alarms such as power failure, high and low temperatures, entrapment, and door open. System to include a built-in panic alarm. The system is to be interconnected to the Building Automation System (BAS) or the Owner’s Network (by Division 27) and to notify facility personnel of the district/owner choosing when activated.

L. Heated Illuminated Push Button Panic Alarm with protective cover and Phenolic Label “PANIC ALARM” for entrapment **within Freezer** (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm to panel above Freezer door (or Cooler door if ‘inline’ assembly) for installation of Emergency Strobe/Horn. Division 26 will provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium). Division 27 will interconnect the Push Button Panic Alarm to the Building Automation System for Owner notification. Refer to Section 1.4: OTHER DIVISIONS/CONTRACTORS RELATED WORK; Subsections F. Division 26 (**Electrical**) and G. Division 27 (**Communication**) for additional information.

M. KE2 Smart Access (unless otherwise specified). Confirm all component model numbers for complete installation and operation.

N. LED surface-mounted light fixture, in quantity/arrangement shown on drawings. Light fixtures to be perpendicular to coils. Light fixtures wired to interior and exterior temperature control panel. Light fixtures are to be provided by Section 11 40 00 and installed by Division 26. Division 26 is to seal all conduit penetrations at light fixtures. KEC to verify that penetrations are sealed.

O. Penetrations of Panels: To be sealed by factory installer and appropriate trade contractors, with Dow Corning 3-6548 silicone RTV foam, total depth of the panel. Trim excess flush. KEC to verify that all penetrations are sealed.

P. Install closure panels and trim strips to building walls and ceiling with concealed attachment. Closure material: same as wall panels unless noted otherwise.

Q. Compartment Entrance Doors: 36” x 78” nominal clearance unless otherwise noted.

1. Mount hinged doors on two Kason Model No. 1346; polished chrome-plated nylon cam-lift hinges.

2. Hinge doors as indicated on drawings.

3. Defrost heater: Thermostatically controlled and replaceable at the entire perimeter of all doors, except when using clear Lexan doors (in addition to door jambs). Defrost heaters to be wired for continuous service.

4. 36” high x full-length diamond aluminum treadplate at front and rear of all hinged doors.

5. 12” x 2” engraved phenolic plastic compartment identification sign in Architect’s color selection with 1” letters, mounted above door window.

6. 14” x 24” four-panel glass view window with heater and molded non-metallic inner and outer frame. The heater is to be wired and controlled via the door monitor for continuous service.

7. Padlock/key provisions in the door latch with safety release mechanisms.

8. Kason 1826 Intelli-Vent LED Heated Pressure Relief Ports with Dual Port Vent and Security Light. Locate One (1) 12” below ceiling on Cooler/Freezer common wall panel and One (1) 12” below ceiling on Cooler wall panel. If Cooler and Freezer are separate units, locate one on the Freezer wall panel as well, 12” below ceiling and mounted in the door frame assembly. All ports to have separate dedicated electrical connections and be wired for continuous service. Located and installed by Manufacturer.

9. Kason Model No. 0487 (unless specified otherwise) Frost Free inside release with fiberglass rod and plastic flange with safety flow plastic knob – ADA compliant.

10. Manual backup vacuum release mechanism to punch hole in Freezer panel assembly to release vacuum within Freezer assembly. Mechanism to include a pull-down handle with freeze-proof hand grip. Handle to have the ability to penetrate and/or punch hole in panel accordingly to assist with opening of door in the event of entrapment (and failure of frost-free inside release button). Door panel to include knock-out section to assist with requirements. Release mechanism assembly to be built-in/mounted to the door assembly structural frame to minimize mechanism tear-out and/or failure. Handle to be painted yellow with phenolic label “Vacuum Pressure Release.”

R. Provide refrigeration calculations and refrigeration alarm to meet local jurisdiction code requirements.

S. If air screens or air shields are specified above doors or on the interior of the assembly, the manufacturer must provide adequate blocking in panels to support these components and pre-wired electrical connections. Installer to coordinate location of door closure to not interfere with air screens or air shields. Clear-VU, swinging door assemblies, are not required if air shields are specified.

T. S/S trim above walk-in assembly to conceal manufacturer ceiling grid.

U. Field-check all horizontal/vertical measurements and conditions at the building before fabrication or delivery of equipment.

V. Walk-in Assemblies to be installed by the PRE-APPROVED INSTALLERS listed below:

1. QBR Refrigeration, 30083 Hwy 90 Blvd., Katy, TX 77493, Mr. Andy Spellins, 713-973-2875, andy.spellins@qbrsales.com

2. Machine Ice, 8915 Sweetwater Ln., Houston, TX 77037, Mr. Will Weaver, 281-448-7823

3. Coolers Inc., 6922 Alder Dr., Houston, TX 77081, Mr. Lee Mamone, 713-665-8886

2.34 WALK-IN COLD STORAGE ASSEMBLY REFRIGERATION SYSTEMS

A. Unit Coolers: specified quantity and model, ceiling-hung by ½" OD nylon bolts with stainless steel washers and nuts. Insert hanger bolts through the plastic sleeve and seal penetration airtight.

1. Unit cooler drain fittings: positioned as indicated on drawings. Installation of cast tee-fittings on drain pan outlet with union and cleanout plug and extension of 1" Type K copper drain line through wall panel to airgap fitting or floor drain under this Section.

2. Slope drain line ½" per foot, trap at the exterior of assembly and turn down into the drain. Manifold drain lines of adjacent compartments wherever possible.

3. Install drain line plastic sleeve through compartment wall, seal around drain line, and install stainless steel escutcheon with setscrews.

4. Electric drain line heater cable (self-regulating 7 watts): on all unit coolers operating below 36°F., installed from coil drain line fitting to wall penetration under this Section. Heater cables: the minimum rating of 15 watts/lineal foot, 208 volts, single phase. Wrap drain line with maximum 2" loop spacing and interwire to unit cooler for continuous operation.

5. Mounted, pre-piped, and pre-wired evaporator components:

a. Sporlan thermostatic expansion valve with external equalizer.

b. Shut-off valve at evaporator suction and liquid lines.

c. Sporlan "Catch-All" refrigerant filter/dehydrator on liquid line.

d. White Rogers 1609-101 adjustable thermostat with remote bulb positioned in return airstream of the evaporator.

e. Electrical disconnect switch in NEMA 4 enclosure.

f. **For any facility within 20 miles of a salt air environment:** Condenser and Evaporators to be built with Electrofin coating to retard salt air deterioration. Coils are to be coated with Technicoat 10-2 coating for protection against a salt air environment.

g. 110° Ambient Temperature Operation.

6. Two (2) fan door activation switches to turn off evaporator coils when the door is opened.

B. Refrigerant System Installation:

1. Refrigerant Lines; Type "L" rigid copper tubing. Fittings: Wrought copper or brass designed for use with high-temperature solder. Piping joints: Made with silver solder (Sil-Fos). Piping: Properly suspended from and anchored to the structure with adjustable hangers 6' OC maximum. Suction lines: Sized to have a maximum pressure drop of two pounds in medium-temperature systems; one pound in low-temperature systems. Liquid lines: Sized to give maximum pressure to prevent trapping of oil. Insulation on all suction lines: Armaflex insulation by Armstrong. ¾" thick at medium-temp 1" thick at low temp. Refrigerant lines in PVC conduit: Sealed at both ends with

Dow Corning 3-6548 silicone RTV foam. The refrigeration system installer will wrap Exterior Refrigerant Lines in the self-fastening jacket of Type 3003-H14 aluminum alloy 0.016-inch thick. Provide aluminum strapping and seals for applying aluminum jackets and covers according to the manufacturer's recommendations for a completely weather-tight covering.

C. Evacuation and Charging:

1. After completion of the pressure test, the system shall be evacuated using an approved auxiliary vacuum pump. Connections for evacuation: Following the manufacturer's recommendations.

2. Charging after the initial charge, which is contained in the condensing unit (R448A Non-CFC Ozone Depletion Refrigerant for medium and high temp units, R513A - Non- CFC Ozone Depletion Refrigerant on low temp units) – (Refrigerant must meet District Standards, Industry Standards, and local Codes): given through the charging valve in the high side passing all of the liquid refrigerants through a charging dehydrator. All charging lines and gauges must be purged of air before connection with the system. Refrigerant: unused and shall be delivered in clean containers. After the system is fully charged: start and place it in full operation.

D. Refrigeration system to be installed by the **PRE-APPROVED INSTALLERS** listed below:

1. QBR Refrigeration, Mr. Andy Spellins 30083 Hwy 90 Blvd., Katy, TX 77493, 713.973.2875, andy.spellins@qbrsales.com

2. Machine Ice, Mr. Will Weaver, 8915 Sweetwater Ln., Houston, TX 77037, 281.448.7823

3. Coolers Inc., 6922 Alder Dr, Houston, TX 77081, Mr. Lee Mamone, (713) 665-8886

2.35 PRE-APPROVED KITCHEN EQUIPMENT CONTRACTORS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid.

B. **Any contractor requesting inclusion within this bid must submit AIA form 305 a minimum of 14 days before the bid date for review or as required by Architect.**

1. Stafford Smith, Mr. JP Garcia, 7129 North Loop East, Houston, TX 77028, Phone: 713.892.5001, Email: jpgarcia@staffordsmith.com

2. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, Phone: 713.466.8722, Email: aharman@txmetalequip.com

3. Kirby Restaurant Supply, Mr. Brian Kernan, 809 S. Eastman Road, Longview, Texas 75602, Phone: 903.757.2723, Email: briank@kirbysupply.com

4. Mission Restaurant Supply, Mr. Brian Mosher, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 210.354.0690, Email: brianM@missionrs.com

5. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 409.769.1199, Email: terry@kommercialkitchens.com

6. Supreme Fixtures Co., Inc., Mr. Tim Hampel, 11900 Vinny Ridge Road, P.O. Box 193655, Little Rock, AR 72219, Phone: 501.455.2552, Email: tim@supremefixture.com

7. Amundsen Commercial Kitchens, Mr. Lewis Beville, 105 Montie, Longview, TX 75604, Phone: 903.576.6354, E-mail: lewis@afeok.com

2.36 PRE-APPROVED STAINLESS-STEEL FABRICATION SUPPLIERS

A. Only the following named Subcontractors and those approved later, if any, are approved for inclusion in the Contractor's Bid. Pre-approved fabricators shown below shall not sub-out fabrication.

B. **Any supplier requesting inclusion within this bid must submit AIA form 305 at least 14 days before the bid date for review or as required by Architect.**

1. Texas Metal Equipment Company, Mr. Andrew Harman, 6707 Mayard, Houston, Texas 77041, Phone: 713.466.8722, Email: aharman@txmetalequip.com

2. Kommercial Kitchens, Mr. Terry Woodard, 13544 East Fwy., Houston, TX 77015, Phone: 832.767.5287, Email: terry@kommercialkitchens.com

3. Mission Restaurant Supply, Mr. Brian Mosher, 1126 S. St. Mary's Street, San Antonio, Texas 78210, Phone: 210.354.0690, Email: brianM@missionrs.com

4. CSS Manufacturing, Mr. Jared Woodard, 7430 Fairbanks North Houston Rd., Houston, Texas 77040, Phone: 832.444.6311, Email: jared.woodard@css-mfg.com

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Supervision: Provide a skilled and proficient foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: Coordinate with the progress of construction and Owner's operation schedules. Unless otherwise instructed and documented by Owner or General Contractor, the following procedures apply:

1. Field-Assembled Fixed Equipment integrated into the structure (e.g., walk-in assemblies, exhaust hoods, drain trench/grate assemblies, conveyor systems, ceiling-mounted utensil racks, etc.) are to be sent to the job site when directed by the General Contractor and installed/protected accordingly.

2. All other Fixed Equipment: delivered after completion of work on adjacent finished ceilings, lighting, finished floor and wall systems, including painting.

3. Major Movable Equipment: delivered, when possible, to inventory in a secured area for interim job-site storage or, if the secured area is unavailable when fixed equipment installation/clean-up has been completed.

4. Minor appliances and loose items (e.g., pans, covers, flatware containers, etc.) should be delivered only when the Owner is prepared to receive and inventory such items.

C. Installation: performed by the manufacturer of custom fabricated fixtures.

1. Assemble, square, level, and ready all items for the final utility connections.

2. Cut neatly around obstructions to provide sanitary conditions.

3. Where gaps of ¼" or less occur adjacent to or between equipment, insert rope backing and smoothly apply General Electric construction sealant Series SE-1200 silicone mastic (silver color). Mask both sides of the gap for neat sealant application and remove excess. If space exceeds ¼," neatly install 18-gauge stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement or "Z" clips wherever possible to secure stainless steel trim. Exposed edges or corners of trim: eased and smooth.

4. Refrigeration coil drain line runs to an indirect drain connection greater than 2" from the face of the wall or panel: Either of the following field procedures:

a. Trench the floor and provide a 6" wide x 2" deep 16-gauge stainless steel sloping (-1" to -2") trough from the face of the cooler/freezer wall to the body of the floor sink/floor drain. Trough: turned up 4" at the wall; ¾" flange with ½" turndown at both long sides. Set trough in waterproof mastic and seal 1" OD drain tube penetration into floor sink/floor drain at -2½" BFF. Patch the floor to match adjacent material/surface.

b. Provide 12" x 6" x 2" deep 16-gauge stainless steel condensate pan mounted to cooler/freezer wall at 6" AFF clear. Trench the floor and install a 1" OD drain line from the bottom of the pan to the body of the floor sink/drain. Slope drain line ¼" per foot and seal all connections watertight. Patch the floor to match adjacent material/surface.

D. Protection of Work:

1. Fabricated fixtures: Fiberboard or plywood taped to tops and exposed body panels/components.

2. Manufactured Equipment: Fiberboard or plywood taped as required by equipment shape and installation-access requirements.

3. Prohibited use of equipment: Tool and materials storage, workbench, scaffold, stacking area, etc.

4. Damaged Equipment: Immediately documented and submitted to the Owner with the Contractor's recommendation of action for repair or replacement and its impact on the Project Schedule and Contract Amount, if any.

3.2 CLEAN AND ADJUST

A. Clean up and remove all debris from this Work from the job site as the installation progresses.

B. Lubricate and adjust drawer slides, hinges, and casters.

C. Adjust pressure regulating valves, timed-delay relays, thermostatic controls, temperature sensors, exhaust hood grilles, etc.

D. Clean or replace faucet aerators and line strainers.

E. Touch-up damage to painted finishes.

F. Start up and check the operation of all refrigeration systems for at least 72 hours before acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

A. Carefully test, adjust, and regulate all equipment following the manufacturer's instructions and certify in writing to the Owner that the installation, adjustments, and performance are in full compliance.

B. Provide the Owner or food service Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance. Coordinate and schedule selected equipment items and attendees with the Owner at least two weeks before the demonstration starts.

3.4 FINAL OBSERVATION

A. Final observation will be made when the Contractor certifies that they have completed their work, thoroughly reviewed the installation/operation of each item in the contract and found it to comply with the Construction Documents.

B. Repetitive final observations (more than two) and all costs associated with it which may be incurred due to the Contractor's failure to comply with the requirements of this Article will be invoiced to this Contractor on a $70.00/hr and expense basis.

PART 4 - EQUIPMENT SCHEDULE

4.1 REGULARLY MANUFACTURED EQUIPMENT/COMPONENTS: Standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

4.2 FABRICATED AND FIELD-ASSEMBLED EQUIPMENT: Arrangement and configuration as shown on Plans, Elevations, Detail Drawings, and outlined in Specifications.

4.3 REFER TO DRAWINGS: For unit quantities and plumbing, electrical or mechanical provisions are required, including the manufacturer's optional voltages, wattages, burner capacities, etc.

4.4 REFER TO PART 2 – PRODUCTS: For accessories, fittings, requirements, and procedures related to the listed buy-out and fabricated equipment.

4.5 ALTERNATE MANUFACTURER REQUIREMENTS: A specific product manufactured by the listed pre-approved equals shown under Section 4.7 Food Service Equipment are acceptable only if the specific product can evidence compliance with the specified line items and the contract documents (Refer to Section 1.6; Sub-Section A.).

4.6 RE-USED EXISTING EQUIPMENT IF PROVIDED IN THIS PROJECT

A. Existing equipment scheduled for re-use is to be inventoried and documented that equipment is in operating condition once Kitchen Contractor has taken ownership.

B. Provide pictures of all equipment once inventoried and issue them to the architect to ensure that equipment has not been damaged.

C. Verify the locations of all equipment with the owner.

D. Existing equipment that is to be reused may need parts or accessories for proper and complete operation. Submit a report listing all items with pricing for approval to allow complete installation.

E. Utility disconnection and re-connection: Under Divisions 22 and 26. Kitchen Contractor to verify utility requirements of existing equipment and coordinate with Foodservice Design Professionals (FDP) as required. If utilities shown on FDP drawings do not match the requirements of existing equipment – KEC is to relay that to FDP immediately. All utilities not scheduled for re-use must be capped and covered by required disciplines.

F. Disassembly, removal, transportation, and relocation: under this Section and scheduled with General Contractor. The owner's representative must be present and coordinate the date/time with the owner.

G. Thoroughly clean inside and out before relocation.

H. Review functional parts (e.g., doors, controls, heating elements, compressors, etc.) and submit a report of required repairs and cost estimates. Any finishes or equipment damaged due to construction will be repaired as required.

I. Existing equipment not scheduled for reuse is to be carefully removed/relocated by the Kitchen Contractor per the Owner's direction. Kitchen Contractor to coordinate the date/time with General Contractor and Owner.

J. Removal or replacement of existing equipment is to be scheduled for times of least interruption and inconvenience to the food service operation. Submit the proposed time frame schedule, task sequence, and process for approval before starting work.

K. Kitchen Contractor to verify size and shape for all existing re-used equipment and coordinate with Foodservice Design Professionals (FDP) as required.

L. Any modification(s) required/desired for re-used existing equipment to be verified by the Kitchen Contractor. Before the changes are made, all modifications must be approved by the Owner and Foodservice Design Professionals (FDP).

M. The KEC is to verify and coordinate all the utility requirements with the construction documents as required. Refer to the general specifications regarding conflicts.

4.7 FOOD SERVICE EQUIPMENT

A. All equipment is to have a performance check from factory-authorized personnel. Warranties will begin on the day of the performance check.

B. All equipment and internal components should be of domestic origin where possible.

C. Architect to verify/coordinate the aesthetic options below (Food Service color, material, or signage selections) if these items are provided in this project:

1. Countertops: Stone (stainless steel is provided unless otherwise specified)

2. Tray slides: Corian or Stone (stainless steel is provided unless otherwise specified)

3. Counter fronts: Ceramic tile, 3 Form, or Plastic Laminate

4. Sneeze Guards: Stone insets

5. General color, material and graphic selections:

    a. Display Air Screen Merchandisers – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)

    b. Bakery Display Cases – Color selection: Powder Coat or Plastic Laminate (stainless steel is provided unless otherwise specified)

    c. Pass Thru or Reach In Holding Cabinets - Color selection: Powder Coat (Mfg.: True) or Plastic Laminate (Mfg.: Traulsen) (Stainless steel is provided unless otherwise specified)

    d. Hanging Heat Lamps – Track and Fixture color selection

    e. Heated Merchandisers

    f. Portable Guide Rails – Stanchion and Belt color selection

    g. Popcorn machine – Signage selection

    h. Bottle Cooler – Signage selection

    i. Graphics Package information

    j. Hot Food Well covers

D. Architect to verify/coordinate the finishes below:

1. Walls: Ceramic Tile, Flat FRP, or Molded FRP (Smooth, Impervious, and easily cleanable as approved by local jurisdiction)

2. Ceilings: Removable Vinyl Face Tile (Smooth, impervious, and easily cleanable as approved by local jurisdiction)

3. Floors: Tile, Epoxy, or Rubberized flooring system (Smooth, impervious, easily cleanable and slip resistant as approved by local jurisdiction) (Coordinate floor tile transition at serving lines)

4. Floors: Walk-in Assembly – Extend kitchen floor flush into Walk-in assembly with coved base

5. Furr Downs above Serving Counters

LAMAR ELEMENTARY SCHOOL #38

ITEM NO. 101 AIR SCREEN

QUANTITY 1

Manufacturer:	Mars
Model:	STD248-1UA-OB standard ext.
Size and Shape:	Refer to drawings
Alternate:	Berner

1. Air curtain, STD2 series model, unheated, obsidian black exterior. Size unit to fit door.
2. Air Curtain to include Model #J0023 Controller Kit. Controller kit to come complete with plastic magnetic reed switch, surface mounted, .50 HP max, 115v/1-ph limit switch. The magnet to be mounted on the surface of the door jamb and the door.
3. Confirm clearance above door prior to installation. Air Curtain to accommodate door width and height.
4. 114000 to provide magnetic reed switch kit loose to General Contractor for installation by Division 26. Division 26 to route flexible conduit to j-box on cabinet. Routing to be clean and secured to building.
5. Provide Harsh Weather Cover if no awning or recessed door is provided.

ITEM NO. 102 COLD STORAGE ASSEMBLY

QUANTITY 1

Manufacturer:	Thermokool
Model:	---
Size and Shape:	Refer to drawings
Alternate:	American Panel

1. Installation to be completed by Factory Approved / Authorized installer. Refer to Section 2.33 Submittal drawings to include factory approval letter or certificate.
2. Manufacturer to review final installation and provide a letter confirming installation meets manufacturer requirements.
3. Assembly to have 9'-6” interior clearance.
4. 304 #3 finish 20 gauge stainless steel finish where exposed, 20 gauge galvanized steel where concealed.
5. Factory floor with smooth aluminum finish, recessed in slab 8 1/2". Secure floor to wall assembly with cam-lock assembly. KEC to ensure the floor assembly is level prior to the wearing bed installation. Kitchens finished floor to extend to walk-in.
6. Threshold to be smooth and level with finished floor. **- Critical.**
7. Interior walls to be .040” aluminum, white embossed texture on walls.
8. Ceiling to be embossed textured .040” aluminum baked white enamel.
9. Two (2) 36" doors. Doors to be 18-gauge stainless steel, type 304 (18-8), #3 finish, with heated perimeter / door jambs / windows and threshold heaters. Each door to be equipped with 3'-0" high diamond tread kick plate on both sides of doors. Mount hinged doors on two (2) Kason model no. 1346 (or equal); polished chrome plated nylon cam-lift hinges.
10. Provide heated illuminated Push Button Panic Alarm with protective cover and Phenolic Label “PANIC ALARM” for entrapment within Freezer (ADA mounting height). Panic Alarm Encasing is to be stainless steel (not plastic). Manufacturer to pre-run conduit within panel from Panic Alarm

to panel above Freezer door (or Cooler door if ‘inline’ assembly) for installation of Emergency Strobe/Horn. Division 26 will provide (2) external Emergency Strobe/Horn Beacons and interconnect the Push Button Panic Alarm to external Beacons (One above the Freezer door and One in the Cafetorium). Division 27 will interconnect the Push Button Panic Alarm to the Building Automation System for Owner notification.

11. Reinforcement as required to be provided above Freezer door (exterior) and panel next to door (handle side - interior) for mounting of Emergency Strobe Beacon, Push Button Panic Alarm and Release Knob.
12. The Cooler will have the standard control panel with standard panic button tied into the Owner's network for notification.
13. Provide Kason model no. 0487 Frost Free Inside release (or equal) for each cold storage door assembly. Fiberglass rod and plastic flange, with safety glow plastic knob, ADA compliant.
14. 18-gauge stainless steel, type 304 (18-8), #3 finish trim where adjacent to walls and enclosure panels that extend to 2" above finished ceiling.
15. Freezer One (1) lot LED light fixtures to operate in temperatures to -20 F. Lights to be installed perpendicular to coils.
16. Refrigerator- One (1) lot LED light fixtures. Lights to be installed perpendicular to coils.
17. 3’-0” high diamond tread plate at exposed exterior surfaces. Fasten to wall with stainless steel fasteners.
18. Provide door bumper at doors.
19. Compartments to have all electrical concealed within the walls or located above the ceiling.
20. Provide Manufacturers alarm/control system that includes hi/low limits . Route temperature sensor to be located to the side of evaporator coil.
21. Doors to be provided with CCI Industries, Inc., Clear-VU swinging door assemblies, Alternate: Kason.
22. K.E.C. to provide aluminum coved base to interior and exterior of assembly. Provide sealant between floor and wall panels.
23. All holes in assembly to be sealed by factory installer.
24. Pressure relief port to be sized per manufacturers recommendations, locate on cooler/freezer common wall and on cooler wall.
25. KEC to field verify all horizontal/vertical measurements and conditions at the building prior to fabrication or delivery of equipment.
26. KEC to provide 1-year walk-in panel installation warranty. KEC is responsible for overall install accuracy/quality and quality control of work performed regardless of installer or any field modifications due to building/construction conditions. KEC to provide Letter of Install Approval to FDP upon completed install.
27. Manufacturer to provide One Year Parts and Labor Warranty.
28. Interwiring of temperature monitor panel to master building alarm system or to the Owner’s network. Technology department to provide all interfacing of alarm system and with the building alarm system. Conduit from refrigeration system to monitor by Division 26. Temperature Monitor installation at 4'-0" above finished floor. All conduit to be located above walk-in cooler/freezer ceiling. Exposed electrical conduit is not acceptable.
29. Manufacturer Representative to provide training on controls and inside emergency release mechanisms.

ITEM NO. 103 REFRIGERATION SYSTEM-STANDARD

QUANTITY 1

Manufacturer:	RDT
Model:	ZS1-2 EcoSmart
Size and Shape:	Refer to drawings
Alternate:	---

1. Air cooled system.
2. Scroll Compressors.
3. Cooler temperature to be +35 degrees.
4. Freezer temperature to be -10 degrees.
5. EcoSmart system on demand defrost.
6. KE2 Evap Controllers located per Owner requirements.
7. S/S covered housing.
8. A dedicated electrical connection to be provided for heated condensate drain line. Refer to electrical plan for location.
9. All exterior piping to be aluminum wrapped.
10. System to accommodate Item No. 102 Cold Storage Assembly.
11. S/S covered housing mounted to a 24" tall 1/8 galvanized angle iron frame anchored to concrete pad. Provide S/S skirting around frame.
12. Mount condensing unit on common exterior rack. Refer to Architectural and Engineering drawings for exact location of remote unit. Coordinate routing of refrigeration lines and conduit with appropriate trades. Heat tape and insulate all drain lines. General Contractor to seal all building penetrations at refrigeration lines.
13. Provide two (2) year parts and labor warranty for all parts and components (including third-party components that may be utilized).

ITEM NO. 104 COLD STORAGE SHELVING

QUANTITY 2

Manufacturer:	Metro
Model:	Metro Max Q
Size and Shape:	Refer to drawings
Alternate:	AMCO

1. Each unit to be four (4) tiers high with open grid mats.
2. Four (4) 74" post per unit. Provide foot plates at all posts when assembly is supplied with walk-in floor.
3. Refer to drawings for size, width and lengths.
4. Quantity Two (2) to equal One (1) lot: all shelving shown within cold storage assembly.
5. Verify shelving requirements with approved submittal prior to ordering.

ITEM NO. 105 DUNNAGE RACK

QUANTITY 4

Manufacturer:	Metro
Model:	Metro Bow Tie
Size and Shape:	Refer to drawings

Alternate: AMCO

1. Size as shown.

ITEM NO. 107 DRY STORAGE SHELVING

QUANTITY 1

Manufacturer: Metro
Model: MetroMax Q
Size and Shape: Refer to drawings
Alternate: AMCO

1. Each unit to be five (5) tiers high with open grid shelving.
2. Four (4) 86" posts per unit.
3. Quantity One (1) to equal One (1) Lot: all shelving shown within the dry storage room.
4. Refer to drawings for size, width and lengths.
5. Verify shelving requirements with approved submittal prior to ordering.

ITEM NO. 109 ICE MAKER WITH BIN - 500 LB CAPACITY

QUANTITY 1

Manufacturer: Manitowoc
Model: IYT-0450A/D570
Size and Shape: Refer to drawings
Alternate: Scotsman, Hoshizaki

1. Energy Star Rated.
2. Stainless steel bin.
3. Stainless steel legs.
4. Provide bin adapter kit as required.
5. Easy Touch Controls, set filter reminders, get error messages/faults, program run/stop times, display serial/model information, view step-by-step cleaning/sanitizing prompts, view warranty expiration timer.
6. Provide Luminice II Virus and Bacteria Inhibitor.
7. Provide sizes and quantities as required: Dormont s/s water disconnect from filter to Ice Machine.
8. Cord and plug assembly, coordinate NEMA configuration with electrician.
9. One (1) pre-filter and water filter sized to manufactures recommendations. Provide two (2) sets of replacement filters. Mount on wall adjacent to ice machine in an easily accessible location.
10. Coordinate cord and cap with receptacle. Water supply to filter to be hard copper plumbed. 72" long flex hose from filter to ice maker with 48" wall restraint cable. Interconnection thru water filter to ice machine and final connection by Division 22. Water filter overflow tube to be strapped to back side of ice machine and extend to 1" above floor sink.

ITEM NO. 110 CLOTHES WASHER

QUANTITY 1

Manufacturer: Owner Furnished
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Cord and plug assembly, coordinate plug configuration with Div. 26.
2. Top load washer.
3. Final connection by Division 22, 26. Coordinate with G.C.

ITEM NO. 110A CLOTHES DRYER

QUANTITY 1

Manufacturer: Owner Furnished
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Cord and plug assembly, coordinate plug configuration with Div. 26.
2. One (1) washer installation kit.
3. Final connection by Division 22, 26. Coordinate with G.C.

ITEM NO. 111 CHEMICAL SHELF

QUANTITY 2

Manufacturer: Metro
Model: MetroMax Q
Size and Shape: Refer to drawings
Alternate: AMCO

1. Two (2) MetroMax Q units:A.Four tiers high with open grid mats.B.Four (4) 86" posts per unit.C.Refer to drawings for sizes, widths and lengths.
2. **Special instructions:** Shelving furnished and installed by 114000. G.C. to provide wall blocking when required. 114000 to coordinate size and location of wall blocking.

ITEM NO. 121 TWO COMPARTMENT SINK W. DISPOSER

QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Top: 14 gauge type 304 S/S marine edge with 2" turndown at free sides.
2. Open base construction.
3. 10" high splash where adjacent to walls/fixtures.
4. Two (2) 24" x 26" x 15" deep sink compartments.
5. One (1) T&S model no. B-0291, splash mount faucet, 18" swing nozzle,LL inlets, for ¾" hot and cold water connections.
6. Two (2) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. Provide One (1) T&S model no. B-0133-EE-CR-8C pre-rinse, ***two (2)*** B-0108-C spray head, two(2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
8. 16 gauge S/S undershelf per drawings.

9. Disposer - installed in top integrally welded disposer cone. Notch and punch splash turn back for vacuum breaker. 12 gauge S/S bracket mounted below counter top for disposer control panel ground and polished to match top.
10. 12" deep single post mounted overshelf at 18" above counter top, punched to accommodate spray rinse.
11. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x ¼" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center. Verify height with owner.
12. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray nozzle by owner.
13. Omit rear rail at sink compartments, disposer and front rail at hose bibb.
14. Two (2) "Richlite" ½" thick removable sink covers installed at each sink. Weld ¼" bar stock, set 5/8" below work surface at all four corners for support of sink covers. Two (2) finger holes per board.
15. Provide top and bottom c-channel support storage for sink covers at right or left end of counter.
16. One (1) Edlund model no. S-11 Manual can opener, mounted on raised platform.
17. Flanged feet at front only.
18. Seal at all splash penetrations.

ITEM NO. 123 DISPOSER-CONE MOUNT/SINK MOUNT

QUANTITY 2

Manufacturer:	Salvajor
Model:	(1) 300-CA-ARSS /(1) 300-SA-ARSS
Size and Shape:	Refer to drawings
Alternate:	In-Sink-Erator

1. One (1) 18" Disposer cone with scrap ring, S/S cone cover, Fixed nozzle. Two (2) Swirl inlet located in disposer cone at a 45 degree angle. 2HP. Install at Item 121, Two Compartment Sink.
2. One (1) sink mount assembly; One (1) 6-1/2" sink collar with 6 - 1/2" rubber sink stopper, rubber scrap ring, perforated silver saver. 2HP. Install at Item 254, Soiled and Clean Dishtable.
3. Install vacuum breaker in splash; delete standard syphon breakers and provide T & S B-0456-04 vacuum breakers and mount 6” from tabletop to base of breaker.
4. Solenoid valve.
5. Flow control.
6. Model no. ARSS-LD control panel.
7. Auto-reverse.
8. Dejamming tool.
9. Install vacuum breaker in splash
10. S/S cone cover.
11. Perforated silver saver and disposer cone with scrap ring.
12. Two (2) Swirl inlet located in disposer cone at a 45 degree angle.
13. GC to pipe 1/2" cold water to disposer body and swirl inlets. Excess electrical cord to be secured to fabrication as required. Install into counter by section 114000.

ITEM NO. 124 WORKTABLE W/ OVERSHELF

QUANTITY 2

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Top: 14 gauge type 304 S/S top with 6" high backsplash at wall and 2" turndown at free sides.
2. Open base construction.
3. 16 gauge S/S overshelf post mounted 18" above working surface.
4. 16 gauge S/S undershelf.
5. Two (2) 20" W x 20" L drawer assemblies. Component Hardware #S52-2020 drawer slides with delrin bearings - 200lb capacity. Component Hardware #S81-2020C drawer pan.
6. Close back of splash when exposed.

ITEM NO. 128 UTILITY CART

QUANTITY 3

Manufacturer: Lakeside
Model: 522
Size and Shape: Refer to drawings
Alternate: Piper

1. Four (4) N.S.F. approved non-marking casters, Two (2) with brakes.
2. Extended perimeter bumper.

ITEM NO. 136 BAKER'S TABLE

QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Top: 14 gauge type 304 S/S with 2" square turn down at front, 6" high enclosed splash at sides and rear.
2. Provide finished back at exposed backsplash.
3. 12" deep post mounted overshelf at 18" above counter top.
4. 16 gauge S/S flour trough.
5. Rear rail only.
6. One (1) lot Rubbermaid no. FG360288WHT ingredient bins.
7. One (1) tier of three (3) 20" x 20" x 5" deep all stainless steel drawers. To be in #18 gauge stainless steel housing having 3/4" radius (vertical) exterior corners. S/S drawer liners.

ITEM NO. 138.1 PAN RACK-ROLL IN

QUANTITY 11

Manufacturer: CresCor
Model: 207-UA-13-A
Size and Shape: Refer to drawings

Alternate: Lakeside

1. Four (4) 5" High heat casters with brakes.
2. Adjustable universal slides on 1-1/2" centers.
3. 70" height.
4. Corner bumpers.
5. Omit bumper on roll-in racks.

ITEM NO. 145 WORKTABLE W-SINK-DBL BAR UT RACK

QUANTITY 2

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Top: 14 gauge type 304 S/S, 2" turn down at all sides.
2. Provide table in two (2) sections-one (1) 27" and one (1) 33" section. Refer to detail.
3. Open base construction.
4. Full length 16 gauge S/S undershelf.
5. Four (4) 20" W x 20" L drawer assemblies. Component Hardware #S52-2020 drawer slides with delrin bearings - 200lb capacity. Component Hardware #S81-2020C drawer pan.
6. One (1) 15" x 20" x 10" deep sink compartment. Coordinate location with drain overflow.
7. One (1) T&S model no. B-0320-BB-CR, rigid gooseneck, ceramic cartridges, deck faucet for ¾" hot and cold water connections.
8. One (1) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
9. Post mounted double bar utensil rack, extend 1-5/8" diameter S/S posts from cross rail thru top and weld Two (2) full length 2" x 1/4" S/S bars with 12" radiused outside ends and One (1) additional bar between post with Component Hardware model no. V-77-4401 sliding hooks at 8" on center. Provide gussets for posts at countertop penetrations. Verify height with Owner. 48" max. upright post spacing.
10. Provide a duplex receptacle and housing mounted below countertop per drawings. Interconnect and prewire a 5'-0" cord and plug out of receptacle housing for plugging into ceiling drop cord receptacle. 114000 and Div. 26 to coordinate location of drop cord receptacle.
11. Omit rear cross rail at sink section.
12. Flanged feet, secured to the floor with non corrosive anchors.

ITEM NO. 151 FIRE PROTECTION SYSTEM

QUANTITY 2

Manufacturer: Ansul
Model: R102
Size and Shape: Refer to drawings
Alternate: ---

1. Duct and plenum protection to exhaust hood.
2. Surface protection for cooking equipment.
3. Locate remote fire pulls as recommended by Fire Marshal.

4. One (1) lot Mechanical gas valve (maximum diameter as required). Size as required. Furnished by Section 114000, installed by Division 22. Kitchen Equipment Contractor to coordinate location with local Fire Marshal requirements prior to submittal review. All conduits to be recessed within wall, SURFACE MOUNTING WILL NOT BE ACCEPTED.
5. System to meet U.L. 300 requirements.
6. Provide one (1) hand held Type 'K' and ABC 6 liter fire extinguisher per Ansul System, surface wall mounted. Verify mounting locations as required.
7. Exposed pipe threads are unacceptable.
8. All exposed piping to be chrome plated.
9. All hood penetrations to have U.L. listed "Quick Seal". Provide s/s escutcheons at all hood penetrations.
10. Provide phenolic I.D. labels for exhaust hood, remote fire pull, light/fan switches and fire protection system.
11. Provide a manufacturer performance test and report that verifies this system is fully operational.
12. Provide s/s cabinet as shown on plan.
13. Installer to provide one (1) Ansul system per exhaust hood, review drawings and provide systems as required.
14. Install hand held extinguishers, maximum of 3'-2" A.F.F. to top of unit.

ITEM NO. 152 EXHAUST HOOD

QUANTITY 1

Manufacturer:	Mod-U-Serve
Model:	W-CPB
Size and Shape:	Refer to drawings
Alternate:	---

1. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.
2. Size and shape as per plan.
3. Supply Air. Ceiling mounted supply plenum, coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
4. Insulated make-up air plenum with 1" thick foil faced fiberglass insulation. Locate supply plenum in ceiling, coordinate location with GC as required.
5. U.L. Listed and fire rated 48” recessed LED lights located within the hood canopy. To meet minimum requirements of 50’ candles of illumination.
6. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.
7. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
8. All 18 gauge S/S construction. S/S finish where exposed.
9. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.
10. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
11. S/S filters and grease cup. Provide filter removal tool.
12. ½" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.

13. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
14. S/S c-channel closure panel from top of hood to ceiling.
15. S/S filler panel between hoods if back-to-back.
16. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
17. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
18. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
19. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
20. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
21. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
22. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
23. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

ITEM NO. 153 EXHAUST HOOD

QUANTITY 1

Manufacturer:	Mod-U-Serve
Model:	W-CPB
Size and Shape:	Refer to drawings
Alternate:	---

1. Hood to meet requirements of ALL current local Mechanical and local Energy Codes.
2. Size and shape as per plan.
3. Supply Air. Ceiling mounted supply plenum with light fixtures, coordinate conditioned/tempered air with engineer. Locate supply plenum in ceiling, coordinate location with GC as required.
4. Insulated make-up air plenum with 1" thick foil faced fiberglass insulation. Locate supply plenum in ceiling, coordinate location with GC as required.
5. U.L. Listed and fire rated 48” recessed LED lights located within the hood canopy. To meet minimum requirements of 50’ candles of illumination.
6. Simple on/off switches for hood fans and lights to be provided by Division 26. Control panels will not be accepted.

7. Collars to be field installed. Coordinate with existing conditions and install as approved by Hood manufacturer.
8. All 18 gauge S/S construction. S/S finish where exposed.
9. For extended cooking line-ups provide Continuous Capture canopies without partitions between hoods.
10. Hood to have insulated front face and ends to allow for ceiling grid attachment where ceiling grid meets hood capture area.
11. S/S filters and grease cup. Provide filter removal tool.
12. ½" diameter steel hanger rods at 4'-0" O.C. maximum to be by Kitchen Equipment Supplier, but they are to be anchored to supporting structure (or slab) by the General Contractor in the locations required by exhaust hood shop detail.
13. All hood penetration to be fire rated and U.L. Listed and sealed with s/s escutcheons.
14. S/S c-channel closure panel from top of hood to ceiling.
15. S/S filler panel between hoods if back-to-back.
16. 4" air space at rear of hood. Provide S/S finished back where rear air space would otherwise be exposed.
17. Ductwork and final connection to hood above ceiling to be by the Mechanical Contractor.
18. Clearance requirement: Where any exterior surface of a hood is installed less than 18" from a combustible or semi-combustible surface, provide a minimum of 4" air space containing a code approved fire resistant material to that surface in a manner as prescribed by the manufacturer of that fire-resistant material. Protective materials provided by 3M Fire Barrier Duct Wrap 615+ and Fry Ware Elite are compliant with state and local mechanical codes. In addition, both systems meet the requirements of the testing standards of ASTM E2336 AND ARE THEREFORE APPROVED TO BE USED IN CLEARANCE REDUCTION APPLICATIONS.
19. Provide Mod-U-Serve model number ASTS-90 pre-set temperature sensor for automatic start of exhaust fan when the condition exists where the exhaust fan is not initiated at the wall switch and the temperature in the exhaust canopy reaches 110 degrees F. At the end of the cooking day when the fan is disengaged at the wall switch the thermostat (temperature sensor) will keep the exhaust fan on until the temperature in the exhaust canopy drops below 110 degrees F.
20. Provide minimum 18-gauge stainless steel insulated wall panel 5/8" pan formed, filled with USDA Approved insulation. Extend from top of cove base to underside of hood.
21. Refer to individual hood lengths as shown on drawings for each assembly required. Install at 6'-10" A.F.F. to bottom of hood, coordinate duct and fan requirements with Mechanical Contractor. Interconnect to wall mounted light switch by Division 26. Bulbs for light fixtures to be furnished and installed by Kitchen Equipment Contractor.
22. Mechanical contractor to test and balance exhaust hoods. Balance report to be provided to FDP upon completion.
23. **Special Instruction:** Refer to individual hood and plenum box lengths as shown on drawings for each assembly required. Install bottom of hood at 6'-10" A.F.F. Install plenum boxes recessed and interconnect to wall mounted light switch by Division 26.

ITEM NO. 161 CONVECTION OVEN- GAS DBL

QUANTITY 3

Manufacturer:	Blodgett
Model:	DFG-200 DBL
Size and Shape:	Refer to drawings

Alternate: Vulcan

1. S/S front, top and sides.
2. Two (2) 1/2 HP 2-speed motors.
3. Natural gas.
4. SSI-M solid state infinite control with manual timer.
5. Electronic spark ignition.
6. Five (5) oven racks per compartment.
7. Dual pane thermal windows.
8. Simultaneous door operation.
9. Heavy duty casters, two (2) with brakes.
10. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48” Gas Conn. Kit, 48” long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
11. Dedicated gas connections, do not manifold.
12. Shunt trip breaker by Division 26.
13. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

ITEM NO. 163.1 **30 GAL. TILT BRAISING PAN- GAS POWER TILT**

QUANTITY 1

Manufacturer: Groen
Model: BPP-30GA
Size and Shape: Refer to drawings
Alternate: Cleveland

1. PowerPan tilt braising pan with easyDial Controls, selector dial with LED ring, large display screen.
2. Power tilt with spring-assisted cover with vent.
3. S/S construction.
4. Open leg frame.
5. Steamer pan inserts.
6. Pan carrier.
7. Etch marks.
8. Double pantry swing faucet.
9. Flanged feet. Secure rear to floor with non-corrosive anchors.
10. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48” Gas Conn. Kit, 48” long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
11. Trench Liner to consist of:
12. S/S trench liner by 114000. Installation by G.C.
13. IMC/Teddy or Custom Fabricated.
14. Fibergrate: Gray #2 1" Thick, 1 1/2" squares mesh, Quartz grit top. Provide in two (2) equal sections, all ends to be finished ends.
15. 14 gauge s/s liner

16. IMC Teddy model no. BSPC basket strainer with pullout handle and chain.
17. Location of trench liner is critical. G.C. and 114000 to verify location prior to concrete pour. Oversize trench liner block out to accommodate equipment pour path.

ITEM NO. 165A RANGE W/SPEADER CABINET & FAUCET

QUANTITY 1

Manufacturer:	Southbend
Model:	P16C-X
Size and Shape:	Refer to drawings
Alternate:	Vulcan

1. S/S sides and front.
2. Cabinet base with removable shelf.
3. Removable cast iron grates.
4. Removable drippings tray.
5. 1" rear gas connections.
6. 5" gas flue riser if unit is at Production wall.
7. Casters (2 locking)
8. External pressure regulator.
9. S/S front end caps at manifold.
10. Provide integral model no.P12C-S spreader cabinet and T&S faucet model no. 43-073. Provide heat shield at faucet.
11. Provide Battery Spark Ignition and Flame Failure.
12. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48” Gas Conn. Kit, 48” long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
13. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

ITEM NO. 168 S/S WALL CAP

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. 2" square turndown at free ends.
2. Caulk and seal at wall with clear silicone.
3. Eased edges at exposed corners.
4. Coved turn up at full height wall, extended to ceiling.
5. 18 ga. stainless steel corner guards located at all exposed corners of kitchen. 48" tall. Located at all corners within the kitchen area. Secure to wall with hidden fasteners.
6. Locate per drawings.

ITEM NO. 172 COMBI OVEN - GAS DBL

QUANTITY 1

Manufacturer:	Rational
Model:	ICP 6-FULL/6-FULL N/G
Size and Shape:	Refer to drawings
Alternate:	Alto-Shaam, Convotherm

1. Pre-Installation Site Consultation, to verify building utilities and access are in place for the units ordered prior to units being installed on site.
2. 208/240V 1PH
3. Six (6) 18" x 26" or twelve (12) 12" x 20" pan capacity, per unit.
4. Standard warranty: 2 year parts and labor, installation inspection/start up.
5. Doors hinged per drawings.
6. Combi-Duo Stacking Kit, mobile.
7. Cleaner Tablets
8. Care Tablets.
9. Gastronorm Grid Shelf, qty. 3.
10. Fry baskets, qty. 3 per oven.
11. KEC to coordinate pan accessories with Owner prior to ordering.
12. Four hour chef training.
13. Heat shield.
14. Installation Kit "10", per unit, article number 8720.1560US.
15. Rational offers Certified Installation of units by Commercial Kitchens.
16. System installation to be reviewed by an authorized factory installer, provide report confirming installation meets factory's requirements.
17. Provide Everpure filtration system as recommended by manufacturer. Provide one set of replacement filters.
18. Provide sizes and quantities as required: Dormont s/s water disconnect from filter to Combi Oven,color coded for filtered and non-filtered water.
19. KEC to coordinate filtered and unfiltered water with Combi Oven, do not connect filtered water to unfiltered water connection.
20. Provide quantities and sizes required: Dormont Model #VER-KITCF-2S-48” Gas Conn. Kit, 48” long, dble. Supr-Swivel coupling with SafetyQuick safety fitting, w/coiled restraining device, full port gas valve, antimicrobial coating, lifetime warranty.
21. Water supply to have shut-off valve and back flow preventer furnished and installed by Division 22. Supply water to interconnect thru water filter and then to each oven. Indirect drain line to be ran outside of the footprint of the unit, coordinate location of the related floor sink.
22. Provide Eagle model CC-S, Stainless Steel Caster Cradle Stabilizing Device for all mobile production equipment under the exhaust hoods. Coordinate locations with the Owner prior to installation. Quantity One (1) equals One (1) lot. Alternate: Regency Stainless Steel Caster Placement System, model #600Safetyset.

ITEM NO. 201.1 SERVING COUNTER

QUANTITY 2

Manufacturer:	Moduserve
Model:	---
Size and Shape:	Refer to drawings

Alternate: ---

1. Continuous closed base, angle iron from construction, with utility chase within counter. All electrical conduit and plumbing to be located within utility chase as required. Utility chase to be fully accessible from operator side of counter with removable stainless steel panels.
2. 34" high stainless steel countertop
3. 12" Stainless steel trayslide with inverted "v" runners mounted at 30" A.F.F..
4. Five (5) insulated waterless hot food wells with thermostat. No more than two (2) wells to be on the same load center breaker. Recess countertop at hot food wells to accommodate sheet pan.
5. One (1) BGA or similar design breath protector with serving shelf, heat lamps and display lights , with mirror finish posts. Pre-approved equal: Custom Fabricated. Full service tempered glass display shelves.
6. Bon Chef hot food well covers, verify color selection with architect.
7. One (1) refrigerated cold pans located per drawings. Provide on/off switch in control panel. Provide pan insert divider strip and perforated false bottoms
8. One (1) BGA or similar design breath protector with mirror finished posts and single tier glass display shelf and display lights at cold pan. Breath protector to be self service.
9. Cashiers station to be integral with counter, lockable cashiers drawer, undershelf to accommodate owners POS System, outlet to accommodate POS system and data line.
10. Stainless steel intermediate and undershelves where possible.
11. Stainless steel legs with adjustable kickplates. Coordinate location of legs, legs to be relocated if located on floor sink assembly.
12. Counter fronts to be removable stainless steel panels.
13. Stainless steel louvered panels to be provided on both sides of counter at all compressor locations.
14. Plate shelves: control panel in plate shelf with recessed hot food wells/heat lamps and display lights controls. One (1) NEMA 5-20R, 120 volts, single phase duplex receptacles mounted in recessed panels for general use.
15. One (1) Load Center and Load Center compartment.
16. One (1) plumbing compartment.
17. All electrical to be pre-wired to load center. Electrical to be located in electrical conduit pipe, flex conduit to be kept to a minimum. Exposed conduit will not be accepted. All wiring to be numbered at all junctions, per circuit. Wiring diagram to be provided at each load center door. All receptacles mounted in the counter to be recess mounted and labelled.
18. Dedicated electrical outlets for Milk Cooler, recessed in end panel.
19. Counters to be factory installed, manufacturer to provide floor template and coordinate with mep and furr down requirements.
20. Manufacturers are to bid all items per specifications, deviations from the specified manufacturers or fabrication will not be accepted.
21. Counter template to coordinate with servery walls, furr downs, electrical and plumbing locations. KEC to coordinate installation and any site conditions with the Trade/General Contractor as required.

ITEM NO. 209 DROP FRONT MILK COOLER - 8 CASE

QUANTITY 2

Manufacturer: Mod-U-Serve
Model: MCT-DM1

Size and Shape: Refer to drawings
Alternate: Traulsen

1. 18 gauge S/S fully welded liner.
2. 20 gauge S/S exterior.
3. Double pan insulated doors.
4. High pressure insulated foam.
5. 5" casters, two (2) with brakes.
6. ½" S/S nipple drain.
7. Locking mechanism.
8. Cord and plug. NEMA - 5-15P.
9. Corner bumpers.
10. 8 case capacity.
11. Strip curtains.
12. **Special Instruction:** Coordinate location of electrical receptacle so as to not interfere with location of milk dispenser.

ITEM NO. 212 MOBILE TRAY LOWERATOR

QUANTITY 2

Manufacturer: Piper
Model: ATCA-ST
Size and Shape: Refer to drawings
Alternate: Caddy

1. Wrap around bumper.
2. Solid S/S bottom with finger grip.
3. Verify tray size with owner.
4. Four (4) casters, Two (2) with brakes.

ITEM NO. 214 CASH REGISTER

QUANTITY 2

Manufacturer: Owner Furnished
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

ITEM NO. 249 THREE COMPARTMENT SINK WITHOUT DISPOSER

QUANTITY 1

Manufacturer: Custom Fabricated
Model: ---
Size and Shape: Refer to drawings
Alternate: ---

1. Top: 14-gauge S/S 3" high 1-1/2" rolled rim at free sides, 10" high splash at walls.
2. Open base construction.
3. Omit rear rail at sink.
4. Three (3) 30" x 26" x 15" deep sink compartment.

5. Two (2) T&S model no. B-0291, splash mount faucet, 18" swing nozzle, LL inlets, for ¾" hot and cold water connections.
6. Three (3) Fisher 22306 twist waste valve 3 1/2" x 2" with overflow and tailpiece. Provide 18 gauge S/S bracket for drain handle welded to sink bottom.
7. 12" deep single post mounted perforated overshelf mounted at 18" above counter top.
8. 18-gaugebutt joint wall panel from splash to underside of shelf.
9. Post mounted utensil rack, extend 1-5/8" diameter S/S post from back splash, turn forward 12" and weld full length x 2" x ¼" S/S bar with Component Hardware model no. V-77-4401 S/S sliding hooks at 8" on center.
10. One (1) Chicago model no. 305-VBRCF hose bibb and rack mounted on 12 gauge S/S bracket ground and polished to match top. Hose and spray rinse by owner.
11. Omit front rail at hose bibb.
12. 16-gauge S/S undershelf as per drawings.
13. Flanged feet at front only of counter.
14. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.

ITEM NO. 250 CONVEYOR DISHMACHINE W. EXTERNAL BOOSTER

QUANTITY 1

Manufacturer:	Hobart
Model:	CL44-BAS
Size and Shape:	Refer to drawings
Alternate:	Champion

1. Dishwasher, conveyor type, single tank design, 202 racks/hour capacity, S/S construction, with automatic fill, auto timer, and 115 volt pilot circuit.
2. 15 KW Electric tank heat.
3. 480/60/3.
4. Verify direction of dishmachine with drawings.
5. One (1) Extended warranty - One (1) Year parts and labor.
6. Interior Chamber height to be 4" taller than standard.
7. Single point electrical connection for Motors, Controls and Tank Heat. Div. 26 to provide S/S disconnect switches located as per plans interconnected to dishmachine and external booster heater.
8. Two (2) vent cowls with 4 x 16 vent and damper. Provide 18 gauge stainless steel seamless duct risers 6" above finish ceiling for final connection. The duct: trimmed at ceiling with 16 gauge stainless steel flange with all corners welded.
9. One (1) table limit switch with stainless steel cover to conceal back. Provided by Manufacturer / Installed by Div. 26.
10. Four (4) 20"x20" Peg racks.
11. Four (4) 20" x 20" sheet pan racks.
12. Two (2) 20" x 20" combination racks.
13. Vent fan controls.
14. Drain water tempering kit. Drain water tempering kit is to be installed by Hobart Service.

15. Peak Rate of drain flow = 38 gpm. Division 22 to provide and install backflow preventor between booster heater and filter. Final connection by Division 22. Coordinate location of electrical disconnects on free wall.

ITEM NO. 252 BOOSTER HEATER

QUANTITY 1

Manufacturer:	Hatco
Model:	C-30
Size and Shape:	Refer to drawings
Alternate:	Hubbell

1. Compact booster heater.
2. One (1) Brass Pressure Reducing Valve with By-Pass.
3. 6" adjustable S/S legs.
4. One (1) Phosphate water treatment unit. System to be located in an accessible location.
5. One (1) Shock Absorber.
6. S/S body and base.
7. Division 22 to provide and install backflow preventor between booster heater and filter. Final connection by Division 22. Interconnect to dishmachine by Division 22. Coordinate location of electrical disconnects on free wall. GC to insulate hot water from booster heater to dishmachine.

ITEM NO. 254 SOILED & CLEAN DISHTABLE

QUANTITY 2

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. Top: 14 gauge type 304 S/S 3" high 1-1/2" rolled rim at free sides. 10" high splash at walls.
2. 14 gauge S/S recessed deposit shelf. Extend shelf through opening to be flush with wall at deposit side. Turn shelf down 2" at front with ¾" return at bottom (either scribed into partition or forming reveal). Shelf: integral with dishtable. Provide Component Hardware E32-4900 drain - extend drain line to floor sink.
3. 18 gauge Butt joint wall panel from splash to underside of shelf.
4. Modify rolled rim at the operators side of the tray drop window to have a 3" rolled rim.
5. Install Disposer as shown. Notch and punch splash turn back for vacuum breaker. 12 gauge S/S bracket mounted below counter top and polished to match top for disposer control panel.
6. Provide One (1) T&S model no. B-0133-EE pre-rinse, B-0108-C spray head, two (2) B-0109-04 18" long wall bracket (dealer to cut to correct length), one (1) additional spray face model no. 108SFRK with ceramic cartridges.
7. Removable S/S rack guide assembly, when sink is shown.
8. Provide ½" slope in top towards dishmachine per the general specifications.
9. When shown, one (1) Cookson Model #ESC10 S/S roll down door at the deposit shelf. The door hood is to be mounted to the face of the wall on the operator's side. Push-up operation.
10. Fully welded s/s window frame and s/s trim on face sides and top (both sides), coordinate with roll down door.
11. S/S corner filler at backsplash; slope to dishtable.

12. S/S cover to conceal table limit switch.
13. 2 1/2" backsplash at dishmachine portion, single thickness of s/s will not be accepted.
14. Anchor flanged feet to floor with non-corrosive bolts. Secure wall mounted equipment / components to in wall grounds or anchor plates. Coordinate installation with the general contractor.
15. Radius Turning Bar located per drawings. ¼” x 2” flat S/S bar welded to 1/2" diameter post fully welded to the countertop. 36" radius at turning bar. Fabrication to allow for continuous discharge of racks to the table limit switch. KEC to coordinate requirements with fabrication.

ITEM NO. 255 MOBILE DRYING RACK

QUANTITY 2

Manufacturer:	Metro
Model:	METRO MAX Q
Size and Shape:	Refer to drawings
Alternate:	AMCO

1. Four (4) tier, includes two (2) drop-ins and (1) cutting board/tray drying rack, built in Microban antimicrobial product protection.
2. Two (2) no. 5MPX casters per unit.
3. Two (2) no. 5MPBX locking casters per unit.

ITEM NO. 260 HAND SINKW/SPLASHGUARDS - WALL MTD

QUANTITY 7

Manufacturer:	Advance Tabco
Model:	7-PS-50
Size and Shape:	Refer to drawings
Alternate:	---

1. 20 gauge stainless steel construction.
2. Basket drain and wall bracket.
3. Gooseneck faucet with wrist handles.
4. Soap and towel dispensers by Owner.
5. P-Trap assembly, delete open/close drain valve.
6. Custom fabricated removable end splashes on sides as required by code. Height same as rear splash.
7. Trade contractor to provide temperature adjustment valves as required.

ITEM NO. 738 ROLL-THRU REFRIGERATOR 1 DR

QUANTITY 2

Manufacturer:	Traulsen
Model:	RRI132HPUT-FHS - TALL
Size and Shape:	Refer to drawings
Alternate:	Utility

1. Stainless steel exterior and interior.
2. Interior lights with bulbs.
3. Locking hardware.

4. Furnish start-up and Six (6) years parts and labor warranty. Seven (7) years compressor warranty.
5. S/S Full height doors on both sides, hinged as per plan.
6. Controls to be on kitchen side of unit.
7. Omit plug. Unit to be hardwired.
8. Provide ramps.
9. Special Instructions: Provide opening in wall 2" taller than equipment and 2" wider, KEC to coordinate with GC as required. Trim is not to be secured to the equipment. (PM to coordinate height with pass thru cabinets)

ITEM NO. 741 ROLL-THRU HEATED CABINET 2 DR

QUANTITY 2

Manufacturer:	Traulsen
Model:	RH232HP-FHS - TALL
Size and Shape:	Refer to drawings
Alternate:	Utility

1. Stainless steel exterior and interior.
2. Interior lights with bulbs.
3. Locking hardware.
4. Furnish start-up and Six (6) years parts and labor warranty.
5. S/S Full height doors on both sides, hinged as per plan.
6. Re-hinging feature.
7. Controls to be on kitchen side of unit.
8. S/S removable trim at top of unit.
9. Provide ramps.
10. Fully welded telescoping S/S trim at walls. Trim is not to be secured to equipment.
11. Special Instructions: Provide opening in wall 2" taller and wider than equipment. KEC to coordinate opening with GC as required.

ITEM NO. 800 S/S CORNER GUARDS

QUANTITY 1

Manufacturer:	Custom Fabricated
Model:	---
Size and Shape:	Refer to drawings
Alternate:	---

1. 18 ga. stainless steel corner guards located at all exposed corners of kitchen. 48" tall. Located at all corners within the kitchen area. Secure to wall with hidden fasteners.

ITEM NO. 802 JANITOR SINK

QUANTITY 1

Manufacturer:	ServicePRO
Model:	SB-200
Size and Shape:	Refer to drawings
Alternate:	---

1. Janitor sink, 36” x 24” x 12” high square type.

2. S/S threshold cap, and double s/s wall guards.
3. Stern-Williams ServicePRO SB-200
4. Chrome plated brass wall mounted fitting with check in stops, hook and wall brace, 2-1/2" indexed lever handles on 8" centers. Quarter turn cartridges, 3/4" male hose thread outlet. Chicago 445-897-CP.

END OF SECTION 11 40 00

SECTION 11 52 13 PROJECTION SCREENS

PART 1 – GENERAL REQUIREMENTS

1.01 SUMMARY

A. Section includes:

1. Manually operated, surface mounted, front projection, pull-down projection screens and/or

2. Electrically operated, surface and recessed mounted, front projection, roll-down projection screens.

B. Furnish and install projection screens as shown on drawings and specified herein. Coordinate with other trades where such cooperation is indicated by furnishing installation requirements and details along with the material in adequate time for progress of the work. .

C. All items shall be installed with anchors appropriate to the wall or ceiling construction. Securely install, plumb, level, square with surrounding area to height and location as directed by architect.

1.02 NOT USED

1.03 SUBMITTALS

A. Provide product data for each type of projection screen specified including: Preparation instructions and recommendations, storage and handling requirements and recommendations and installation methods.

B. Show all anchors, grounds, accessories, reinforcement, layout and installation details including:

1. Location of screen centerline.
2. Location of wiring connections.
3. Seams in viewing surfaces.
4. Detailed drawings for concealed mounting.
5. Connections to suspension systems.
6. Anchorage details.
7. Accessories.
8. Frame details.

1.02 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain each type of projection screen required from a single manufacturer as a complete unit, including necessary mounting hardware and accessories.

B. Coordination of Work: Coordinate layout and installation of projection screens with other construction supported by, or penetrating through, ceilings, including light fixtures, HVAC equipment, fire-suppression system, and partitions.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed and other construction where screens will be installed is substantially complete.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Protect screens from damage during delivery, handling, storage, and installation.

1.04 COORDINATION

A. Coordinate work with installation of ceilings, walls, electric service power characteristics, and location.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Draper, Inc., Da-LiteScreen Company, Stewart Filmscreen Corp., Vutec Corporation.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 25 13.

2.03 ELECTRICALLY OPERATED, RECESSED MOUNTED FRONT PROJECTION SCREEN

A. Provide and install one Da-Lite Cosmopolitan Electrol automatic electric projection screen; HDTV 16:9 format; 65” X 116” (5’-5” X 9’-8”), electrically operated 120 volt AC (60 Hz) 2.6 amp. Three wire quick reversal m5tor to be especially designed for the purpose, to be ball bearing and oiled for life, with automatic thermal overload cutout and integral interlocking gears.

B. Draper Inc. Premier, 72-1/2” x 116” overall size (6’-0-1/2” x 9’-8”) is an approved equal.

C. Screen to have pre-set but adjustable limit switches to automatically stop screen fabric in the “up” and “down” position. Stop action to be positive to prevent coasting.

D. Rigid metal roller at least 3" in diameter (to be used on screens 12' and under in width), 5-3/4" in diameter (on screens 14'-18' in width) or 7" in diameter (on screens where either height or width equal or exceed 20').

E. Roller to be mounted on two heavy duty brackets equipped with self aligning bearings.

F. Screen surface to be flame retardant and mildew resistant Matte White with black masking borders standard.

G. Case to be of standard manufacturers color unless otherwise noted.

H. Heavy metal brackets shall be supplied for mounting screen to wall or ceiling. To be complete with 3 position control switch with cover plate. Recessed installation requires access to motor. Screen to be listed by Underwriters’ Laboratories and CSA.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared. Verify rough-in openings are properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install front projection screens with screen cases in position and relationship to adjoining construction as indicated, securely anchored to supporting substrate, and in manner that produces a smoothly operating screen with plumb and straight vertical edges and plumb and flat viewing surfaces when screen is lowered.

C. Test manually operated units to verify that screen operating components are in optimum functioning condition

3.04 PROTECTION

A. Protect installed products until completion of project. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 11 52 13

SECTION 11 61 43 STAGE CURTAINS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes stage curtain rigging and stage curtains:

1.03 SUBMITTALS

A. Product Data: Include types, styles. materials, operating instructions, and maintenance recommendations.

B. Provide Setting Drawings and templates for built-in or embedded anchor devices.

C. Shop Drawings: Include plans, elevations. and detail sections of typical track and rigging elements. Show anchors, hardware, operating equipment, and other components not included in manufacturers Product Data. Include the following:

a. Locations for blocking to be provided by others.

b. Extent of required operating clearances.

D. Calculations: Calculate requirements for supporting curtains, track, and equipment and verify capacity of each curtain, track, and rigging component to support loads.

E. Samples for Initial Selection: Manufacturers color charts showing the full range of colors, textures, and patterns available, together with 12-inch square sample (any color) of each type fabric.

F. Product Certificates: Signed by manufacturers of stage curtains certifying that products furnished comply with requirements.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed installation of stage curtains similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance for five years.

1.05 PROJECT CONDITIONS

A. Field Measurements: Stage curtain openings and dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings.

B. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening and construction dimensions and proceed with fabricating stage curtains without field measurements. Coordinate construction to ensure that actual opening and construction dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.01 CURTAIN FABRICS

A. General: Provide fabrics inherently and permanently flame resistant or chemically flame resistant by immersion treatment to comply with requirements indicated. Provide fabrics from the same dye lot.

B. Colors, Textures, and Patterns; Match Architects samples.

C. Products: Subject to compliance with requirements, provide the following:

1. MEMORABLE Cotton Velvet; by KM Fabrics

D. Description:
   a. Fiber: 100% FR cotton
   b. Weight: 25 oz./lin yd.
   c. Width: 54 inches cuttable
   d. Flame retardancy - Meets or exceeds the minimum flammability requirements of the following:
      1. NFPA 701, test method #1, small scale
      2. ASTM E84-21, Class A
   e. Environmental: PFAS-Free; Clean Air GOLD Certified
   f. Acoustical noise reduction/sound absorption (100% fullness/nap down)
      1. Noise reduction coefficient: 1.05
      2. Sound absorption average: 1.04
   g. Opacity
      Tested in accordance with AATCC 148-2015, “Light Blocking Effect of Textiles and Related Materials,” Blocking 99.9% of transmitted light at 100 foot candles.

2.02 METAL

A. Steel Pipe: ASTM A53, Grade A, standard weight (Schedule 40), black, 1-1/2 inch nominal diameter, unless otherwise indicated.

B. Galvanized Steel Sheet: Commercial-quality, zinc-coated, carbon-steel sheet; complying with ASTM A 653/A G53M, G60 coating designation.

C. Supports, Clamps, and Anchors: Sheet steel in manufacturers standard thicknesses, galvanized after fabrication according to ASTM A 153/A 153M, Class B.

D. Trim and Support Cable: 1/4-inch diameter, 7x19 galvanized steel aircraft cable with a breaking strength of 7000 lb. Provide fittings complying with cable manufacturers written recommendations for size, number, and method of installation, including a drop-forged galvanized turnbuckle to allow for leveling.

E. Inserts, Bolts, Rivets, and Fasteners: Manufacturers standard corrosion-resistant units.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for supporting members, blocking, installation tolerances, clearances, and other conditions affecting performance of stage curtain work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Examine inserts, clips, blocking, or other supports required to be installed by others to support tracks and battens.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION, GENERAL

A. Install stage curtain system according to track manufacturers and curtain fabricators written instructions.

3.04 DEMONSTRATION

A. Engage a factory authorized service representative to test system and to train Owners personnel to rig, adjust, operate, and maintain stage curtains. tracks, and draw curtain machines.

B. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 11 61 43

SECTION 11 66 00 ATHLETIC EQUIPMENT

1.01 SUMMARY

A. Section Includes:
1. Indoor Basketball Goal Supports, Backboards, Goals and Nets.
2. Electric operation for indoor goals.
3. Backboard Safety Padding (screw attached only)

1.02 REFERENCES

A. National Electrical Manufacturers Association: NEMA MG 1 - Motors and Generators.

B. National Federation of State High School Associations: NFHS - Basketball Rules Book.

C. Underwriters Laboratories Inc.: UL - Electrical Construction Equipment Directory.

1.03 DESIGN REQUIREMENTS

A. Design backstops including masts, backboards, and goals to meet requirements of NFHS and the following:
1. Withstand loads without damage to backstop.
2. Transfer loads to building structural frame to prevent overloading and damage to building.

1.04 SUBMITTALS

A. Shop Drawings:
1. Indicate size and location of backstops, mounting details, accessory anchoring members. Show operable backstops in fully extended and retracted positions.

2. Indicate operator locations and mounting details. Include wiring diagrams for electric operators and controls.

B. Product Data:
1. Submit data indicating materials of construction, thicknesses, colors available.

2. Manufacturer's schedules, charts, literature, and illustrations to indicate the performance, fabrication procedures, product variations, and accessories.
3. Manufacturer's installation instructions.

C. Samples: Submit two samples illustrating safety pad color selections.

D. Engineer's calculations of performance requirements for basketball back stops indicating structural requirements based on height allowances and requirements for pipe sizes, structural attachments, sway bracing, and other structural requirements.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include the following.
1. Description of method of operation and motor control system.
2. Parts catalog with complete list of replacement parts.
3. Schematic wiring diagrams of installed electrical equipment.

1.06 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL or another testing firm acceptable to authority having jurisdiction.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum three years experience and approved by manufacturer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept backstops on site in manufacturer's original packaging. Inspect for damage.

C. Store backstops indoors, protected from weather and contamination until installed.

1.09 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.10 COORDINATION

A. Section 01300 - Administrative Requirements: Requirements for coordination.

B. Coordinate backstops supports to distribute loads to building framing without overloading framing.

C. Contractor shall be responsible for coordination of layout of backstops and support framing with the following to avoid interferences:
1. HVAC equipment, ductwork, outlets, and inlets.
2. Fire suppression system piping and sprinkler heads.
3. Lighting.

D. Furnish volleyball net post sleeves to concrete contractor for setting in concrete footings at locations shown on drawings.

E. All exposed metal parts shall be painted a minimum of one (1) coat of flat black enamel with complete uniform coverage and finish. Touch up any damaged part at job site.

F. All exposed wood parts shall be fine sanded to smooth, uniform appearance and finished with two coats of clear polyurethane finish.

G. Verify all gym construction dimensions, details, structural system, MPE systems, etc. to modify and adapt specified backstop model number and installation to construction conditions. Verify change and receive approval from architect and owner prior to fabrication. Verify with Architect any necessary field changes/modifications as needed to meet all game conditions.

1.11 WARRANTY

A. Unless noted otherwise, warrant the Work specified for one (1) year against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming materials and workmanship.

B. Defects shall include, but not be limited to, the following:

1. Rough or difficult operation
2. Noisy operation
3. Loose or missing parts
4. Noticeable deterioration of finish

C. Glass Backboard: Manufacturer's Lifetime warranty

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Specifications are based on named manufacturers. manufacturers listed who produce equivalent products to those specified are approved for use on the Project. Other manufacturer's must have a minimum of five (5) years experience manufacturing products equivalent to those specified and comply with Division 1 requirements regarding substitutions to be considered.
1. Gared Sports; www.garedsports.com
6. Performance Sports Systems; www.perfsports.com
7. Porter Athletic Equipment Co.; www.porter-ath.com

2.02 EQUIPMENT

A. All motorized/electrical operated equipment shall be controlled by a wall mounted touchpad control system
1. Product: TSC1500 Gym Control System (Total System Control 1500) by Performance Sports Systems
2. Controls up to 160 devices
3. Accommodates 75 moving groups
4. Operates 50 auxiliary devices
5. Power panel back up operating system
6. Passcode protected
7. Coordinate with owner to finalize which items shall be controlled by system.

B. BASKETBALL BACKSTOPS, CEILING SUSPENDED – **CONTRACTOR TO VERIFY MODEL REQUIRED BASED ON FIELD-VERIFIED CEILING HEIGHTS**
1. CENTER STRUT - FORWARD FOLDING - REAR BRACED - MOTOR OPERATED - ADJUSTABLE HEIGHT (FOR 28’-0” TO 32’-0” ceiling/structure attachment height)
a) Equal to Porter #917-32, Center Strut, Ceiling Suspended, Forward Fold Backstop (28’-32’ attachment height)

b) Center-Strut vertical front drop frame assembly shall consist of a main, center mast of 6-5/8" O.D. heavy-wall structural steel tube with diagonal side sway braces of 2-1/2" x 1-1/2" rectangular steel tubing.

c) Ends of diagonal brace tubes shall be precision machine cut to provide maximum weld surface contact to form a unitized, back-to-back triangular type structural design to provide superior lateral stability.

(Formed, curved, pinch-cut or flattened type brace connections will not be approved as equal). Top horizontal mast hinge spreader to be of a heavy 4" structural channel to support adjustable suspension hangers.

d) Goal shall mount directly through backboard and into a heavy structural steel weldment Center-Strut which shall be clamped to the vertical 6-5/8" O.D. center support to eliminate any strain on backboard should a player hang on the front mounted goal (conforms to the NCAA latest rules).

e) All fittings shall be attached to the 6-5/8" O.D. vertical drop tube by heavy 1/4" thick precision saddle die-cut formed steel fittings secured in place by 5/8" diameter 'U'-Bolt type hardware. The upper backboard extension assembly shall provide the official NCAA and NFHS regulation of 6" (15.24 cm) from the front of the Center-Strut to the face of the backboard.

f) Center-Strut drop frame shall be suspended by special adjustable hangers (3) to provide for precise plumbing of frame during installation. Support hangers shall be offset 1-1/2" behind centerline of Center-Strut drop frame to properly weight lock unit in playing position without the use of ropes, latches or springs.

g) Rear, 2-3/8” O.D. diagonal back brace assembly shall terminate behind backboard location in a special slide collar bracket which shall operate over a 2-3/8” O.D. heavy wall-plated slide tube as backstop is hoisted to the ceiling. Rear diagonal back brace assembly shall be further supported by 1-5/16” O.D. truss-type bridging. Adjustable collar seat shall be provided for accurate plumbing of backstop.

h) Backstop shall be supported from 3-1/2" O.D. pipe anchored to roof framing members by means of heavy formed, die-cut steel support fittings. Each support fitting (supplied by the backstop manufacturer) to the roof framing, must be capable of supporting a load exceeding 10,000 pounds, with sufficient attachment points to acquire a 60:1 safety factor for support of the entire backstop superstructure system. Certified test results shall be furnished upon request. All cap screws shall be rated a minimum SAE Grade 5. Grade 2 cap screws will not be approved as equal. Superstructure pipes to be reinforced with special truss-type bridging or bracing when truss centers exceed spans of 14'-0".

i) ELECTRIC WINCH - Backstop shall be provided with #00707-000 (3/4 H.P.- 13 amp) electric winch as recommended by manufacturer. Winch shall be fully enclosed worm gear type designed to hold units at any position when raising or lowering backstop. Provide standard Key Switch control. Wiring of all electrical components shall be in accordance with local area codes and in accordance with manufacturer’s instructions.

j) Hoist cable shall be 1/4" diameter galvanized aircraft cable with 7,000 lb. ultimate breaking strength. Swivel pulleys shall be furnished with a 4" diameter cast (ductile iron) pulley sheave with a maintenance free, oil-impregnated bearing for proper hoist cable routing to winch. Pulley assembly and attachment to 3-1/2" O.D. support structure shall be rated at a minimum 9,000 pound load rating. Certified test results shall be furnished upon request.

k) All metal parts shall be painted one (1) coat of flat black enamel. (If special painting or colors are required, specify final painting by painting contractor.)

l) CENTER STRUT HEIGHT ADJUSTMENT SYSTEM - Height adjustment feature will allow goal height settings from 8'-0" to the official 10'-0" for use by all age groups. Unit shall be designed for use with any official size (4' x 6' or 3'-6" x 6') rectangular backboard and companion front mount type goal.

i) Center unitized support frame shall be fabricated by dual, 2-3/16" square heavy-wall zinc plated guide tubes located on 11-3/16" centers. Ends of guide tubes shall be welded to heavy, formed mounting brackets. Heavy formed, die cut steel clamp assemblies (2) shall be provided for securing height adjustment assembly directly to a 6-5/8" O.D. center support structure (No. 900 Center-Strut series basketball backstops).

ii) Outer dual slide tubes shall support heavy structural steel angle sections which extend downward to accept a direct-mount (Center-Strut) goal mounting system. Slide tube assembly shall be provided with a heavy formed steel section to attach a special upper backboard support assembly to secure the unit to the upper two corners of the rectangular backboard on standard (5'-6") mounting centers.

iii) Height adjustment unit shall incorporate a centrally located 3/4" diameter acme threaded rod equipped with precision, hardened steel roller thrust bearings for ease of operation from the playing floor by means of an awning crank type mechanism. Height adjustment system shall incorporate an internal, spring-loaded height locking mechanism to automatically lock and hold unit at any desired goal height during play. Lock mechanism automatically releases when height setting changes are made with adjustment crank assembly. Adjustment crank assembly shall be provided with each pair of height adjustment units. A height setting scale shall be located on the side of the unit to visually determine height settings from 8'-0" to 10'-0" in 3" increments.

iv) Height adjustment frame shall be finished with one coat of flat black enamel. Hardware shall be furnished for mounting unit to a 6-5/8" O.D. vertical support tube.

m. Provide #10797-100 Safety Straps for all units.

C. BACKBOARDS AND GOALS

1. GLASS, DIRECT MOUNT, RECTANGULAR 3’-6” X 6’-0” w/ Torq-Flex 180 Adjustable Goal

a. Equal to Porter #00204 Pro-Strut Mount rectangular glass backboard with aluminum-faced steel frame. **Install at all “end court” locations**. Provide with indoor goal as indicated below.

b. Backboard shall be 3-6" x 6-0" to meet all NCAA, NFHS and professional requirements.

c. Backboard frame shall be of a welded, unitized construction fabricated from heavy wall rectangular steel tubing, aluminum-faced for professional appearance. Unitized frame shall include a vertical center strut with a unique spacer sleeve arrangement at the upper two goal mount hole locations to transmit undue loading during slam-dunks, etc. directly through the glass and into the rear frame.

d. Unitized frame shall be designed to allow the bottom two goal mount holes to pass beneath the glass section to further alleviate stress on the glass. Backside of goal mount structure is provided with two tapped holes (3/8-16) to independently secure backboard to an optional direct mount goal feature which relieves all stress and shock on the backboard frame conforming to the latest NCAA Rules (BR-73, D-5). Backboard frame shall be furnished with heavy steel gusset plates in each corner incorporating keyhole slots for mounting the backboard to support structures at standard mounting centers. Rear backboard frame shall be finished in a durable neutral gray powder coated finish.

e. Glass shall be provided in 1/2" thick, fully tempered (heat-treated) glass section with uniform load and impact strength. Official white border and target area is "fired in" permanently on front side of glass section so that it cannot wear away. Glass section shall be secured to unitized rear frame by means of an attractive, L-shaped brushed aluminum extrusion for optimum durability. Front perimeter frame shall be secured to unitized rear frame with structural truss head rivets. Glass section shall be fitted with shock absorbing neoprene material to cushion and protect the glass section. Goal mounting holes (4) to be on standard 5" (horizontal) x 4-1/2" (vertical) mounting centers.

2. BASKETBALL GOAL & NET (INDOOR)

a. Equal to Porter #00233-000 Power-Flex 180 Adjustable Goal with nylon net or Aalco 28HS4 goal and net.. Porter Ultra-Flex goals and Aalco 28H-TT goals are not acceptable.

b. Goal shall be designed to protect players and equipment by absorbing shock loads due to slam dunking or hanging on the rim, at all levels of competition. Torsion rod/pivot mechanism shall be easily adjustable to meet the latest NCAA (BR-22, Paragraph 9) and FIBA requirements of rebound/elasticity (35 to 50 percent energy absorption) when mounted on any support structure.

c. Rim shall be fabricated from 5/8" diameter cold drawn alloy steel, round formed to an 18" inside diameter ring. Inside diameter of ring shall be positioned 6" from face of backboard by a heavy formed steel, hinged type housing with a removable cover to conceal mounting bolts and entire shock absorption mechanism of goal, and also protect against finger entrapment. Goal mounting plate shall be provided with hardware and a 5" x 5" mounting hole pattern for front mounting on standard glass, wood fiberglass type backboards and is also compatible for use with Center-Strut direct mount type support frames.

Rim shall be rigidly braced by means of special, formed, die cut steel braces on underside for maxinum support. Rims shall be provide with twelve "no-tie" attachment clips for net attachment.

Goal shall be finished in a durable, official orange powder coat finish.

Goals shall be furnished complete with plated mounting hardware and an anti-whip net. Mounting bolts shall be SAE Grade 5.

D. BASKETBALL BACKBOARD SAFETY PADDING

1. Indoor Backboards - Provide **BOLT/SCREW-ON** safety padding kits at each indoor backboard equal to Porter #326. Color as selected from manufacturer's standard range. Submit full range of color samples for selection.

PART 3 – EXECUTION

3.1 Install all equipment in accordance with manufacturers recommended practice and specifications.

A. Athletic equipment supplier shall furnish volleyball post sleeves to contractor for setting in concrete footings at the appropriate requested time.

B. Installer shall inspect all overhead structures to ensure safe and stable installation of ceiling suspended units.

C. Contractor shall verify all clearances for folding units prior to installation including but not limited to lighting fixtures, mechanical ductwork, overhead piping and plumbing, electrical and/or technology conduits and wiring.

D. Contractor shall verify that volleyball net and or badminton net post sleeves are properly set in concrete footings.

E. Attach backstops securely to structure in accordance with manufacturer's printed instructions. Locate hoists as shown.

F. Make final adjustment after installation and clean all support piping of dirt and other substances which may affect final finish.

END OF SECTION 11 66 00

SECTION 11 72 00 AUTOMATED EXTERNAL DEFIBRILLATOR (AED)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Purchase and installation of AED to be located as indicated on the drawings.

1.3 PERFORMANCE REQUIREMENTS

A. Unit shall be semi-automatic external defibrillator of type as suggested by UIL.

B. AED minimum requirements:

1.	Waveform:	Biphasic
2.	Energy:	min 150 joules
3.	Patient Analysis:	automatic – shock advisory system
4.	Charge time:	min 9 sec.
5.	Voice/Audible Prompts:	audible prompts required in English
7.	Written Instructions:	displayed on controls
6.	Controls:	lighted
7.	Battery:	Lithium rechargable
8.	Memory:	Internal Digital
9.	Pads:	Include pre-gelled, self-adhesive, disposable pads
10.	Self Tests:	Automatic
11.	Min Weight:	6.6 lbs.
12.	Warranty:	1 year
13.	Instructions:	Provide complete Quick Start guide, CDROM with training information and training video

1.4 SUBMITTALS

A. Product Data: For AED supplied.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain AED through one source from a single manufacturer.

1.6 PRODUCT HANDLING

A. Coordinate delivery of AED for installation to prevent damage by other trades. Provide replacement of damaged product.

B. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.7 COORDINATION

A. Coordinate installation of AED with Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cardiac Science www.cardiacscience.com
2. HeartSine Technologies, Inc. www.heartsine.com
3. Physio Control www.physio-control.com
4. Defibtech, LLC www.defibtech.com

B. Approved products:

1.	Cardiac Science:	“Powerheart AED G3 Plus”
2.	HeartSine:	“Samaritan PAD 350P (Public Access Defibrillator)
3.	Physio Control:	“Lifepak CR Plus AED”
4.	Defibtech:	“Lifeline AED – DDU-100 package”

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install AED according to Shop Drawings and manufacturer's written instructions. Install plumb and level.

B. Install in AED wall cabinet sized to accommodate AED. Wall cabinet to be semi-recessed and shall not project more than 4” into the room.

C. Install one 3-D wall sign above wall cabinet at min. 80” AFF.

3.2 FIELD QUALITY CONTROL

A. Field test AED after completing installation to verify performance.

1. Adjust or replace units and make other corrections until tested AED perform as specified.

3.3 ADJUSTING AND CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.

B. Clean finished surfaces and touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

END OF SECTION 11 72 00

SECTION 12 21 13 METAL HORIZONTAL LOUVER BLINDS

PART 1 – GENERAL REQUIREMENTS

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes mini-blinds with aluminum louver slats and accessories. Refer to drawings for locations.

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Shop Drawings: Show location and extent of horizontal louver blinds. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other Work, operational clearances, and relationship to adjoining work.

C. Samples for Initial Selection: For each colored component of each type of horizontal louver blind indicated.

D. Window Treatment Schedule: Include horizontal louver blinds in schedule using same room designations indicated on Drawings.

E. Maintenance Data: For horizontal louver blinds to include in maintenance manuals. Include the following:

1. Methods for maintaining horizontal louver blinds and finishes.

2. Precautions about cleaning materials and methods that could be detrimental to finishes and performance.

3. Operating hardware.

1.04 QUALITY CONTROL

A. Source Limitations: Obtain horizontal louver blinds through one source from a single manufacturer.

B. Corded Window Covering Product Standard: Provide horizontal louver blinds complying with WCMA A 100.1.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver blinds in factory packages, marked with manufacturer and product name, and location of installation using same room designations indicated on Drawings and in a window treatment schedule.

1.06 PROJECT CONDITIONS

A. Environmental Limitations: Do not install horizontal louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where horizontal louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish 20 additional slats of average Project slat length of each color selected.

2. Deliver to Developer and obtain receipt for submittal under provisions of Division 1 Specifications sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Horizontal Louver Blinds, Aluminum Louver Slats:
a. Draper, Inc.
b. Hunter Douglas
c. Levolor

2. Substitutions: Refer to section 01 25 13

2. Blinds supplied MUST be available in full range of manufacturer’s standard colors. Architect to select colors.

2.2 HORIZONTAL LOUVER BLINDS, ALUMINUM LOUVER SLATS

A. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radius corners.
1. Provide mini blinds with 1” blades of High (Classic 8 gauge slats w/1-1/2” head rail) or Medium (Classic 6-gauge slats w/1-1/2” head rail) quality.

2. Slat Finish: Ionized Coating: Antistatic, dust-repellent, baked polyester finish. One color to be selected by Architect from manufacturer's standard colors.

B. Headrail/Valance: Integrated headrail not requiring a separate valance or end brackets for finished appearance; formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends; capacity for one blind per headrail, unless otherwise indicated on Drawings.
1. Finish Color Characteristics: Match color, texture, pattern, and gloss of louver slats.

C. Tilt Control: Consisting of enclosed worm gear mechanism, slip clutch or detachable wand preventing overrotation, and linkage rod, for the following operation:

1. Tilt Operation: Manual with clear plastic wand.

2. Length of Tilt Control: Length of tilt control wands/cords: Wands/cords shall be full length of blind less 12" for all blinds where headrail is 7'-0" or less above finished floor. For all blinds where blind headrail is installed at 7'-0" or greater above finished floor, wands/cords shall extend to a minimum of 6'-0" above finished floor for ease of access.

3. Tilt: Full.

D. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.

E. Tilt-Control and Cord-Lock Position: Right side and left side of headrail, respectively, unless otherwise indicated.

F. Ladders: Evenly spaced to prevent long-term louver sag.

1. For Blinds with Nominal Slat Width 1 Inch or Less: Braided string.

G. Mounting: Between jambs of window unless otherwise indicated on Drawings. Mount to permit easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.

1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

H. Colors, Textures, Patterns, and Gloss: As selected by Architect from manufacturer's full range - min 50 available colors.

2.3 HORIZONTAL LOUVER BLINDS FABRICATION

A. Product Standard and Description: Comply with AWCMA Document 1029, unless otherwise indicated, for each horizontal louver blind designed to be self-leveling and consisting of louver slats, rails, ladders, tapes, lifting and tilting mechanisms, cord, cord lock, tilt control, and installation hardware.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials.

1. Lifting and Tilting Mechanisms: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Blind Units Installed between (Inside) Jambs: Width equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed. Length equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail and operating hardware, and for hardware position and blind mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish for Metal: For components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Component Color: Provide rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 HORIZONTAL LOUVER BLIND INSTALLATION

A. Install blinds level and plumb and aligned with adjacent units according to manufacturer's written instructions, and located so exterior louver edges in any position are not closer than 1 inch to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening's operation hardware, if any.

B. Jamb Mounted: Install headrail flush with face of opening jamb and head. Coordinate with frame depth.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean blind surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that horizontal louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 21 13

SECTION 12 24 13 MOTORIZED ROLLER WINDOW SHADES

PART 1 GENERAL

1.01 SUMMARY

A. Provide electrically operated, sunscreen and blackout roller shades as applicable. Work includes local, group and master control systems for shade operation with addressable, encoded, Electronic Drive Units (EDU).

1.02 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

1. Include one-line wiring diagrams, showing power, system, and control wiring.

2. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

C. Product Data: Submit data indicating physical and dimensional characteristics, operating features, and finishes.

1. Include operating instructions.

2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

3. Preparation instructions and recommendations.

4. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

5. Storage and handling requirements and recommendations.

6. Mounting details and installation methods.

7. Typical wiring diagrams including integration of EDU controllers with building management system, audiovisual and lighting control systems as applicable.

D. Samples: Submit two samples, 12 x 12 inches in size, of shade material.

1. For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth samples and aluminum finish sample as selected. Mark face of material to indicate interior faces.

E. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

F. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

G. Warranty: Provide manufacturer's warranty documents as specified

1.03 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701-99.

B. Product Standard: Provide roller shades complying with WCMA A 100.1.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. PVC-Free Shadecloth: Comply with the following.

1. Shadecloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.

2. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified below. Initial submittals, which do not include the Environmental Certification, below will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.

3. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.

1.04 MOCK-UP

A. Provide a mock-up, if Architect requires, of one roller shade assembly for evaluation of mounting, appearance and accessories. Locate mock-up in window designated by Architect. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in installing products specified in this section with minimum three years experience and approved by manufacturer.

1.06 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.07 COORDINATION

A. Section 01 31 00 – Project Management & Coordination: Coordination and project conditions.

B. Coordinate the Work with window installation and placement of concealed blocking to support blinds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Power and control wiring shall be complete and certified, fully operational with uninterrupted communication on the lines and minimal noise certified by a commissioning agent (by others).

1.10 WARRANTY

A. Warranty: Provide manufacturer's standard warranties, including the following:

B. Motorized Roller Shade Hardware, and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

C. Roller Shade EDU's and EDU Control Systems: Manufacturer's standard non-depreciating five-year warranty.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Basis of Design: Manufacturer for Window Shade System: products by MechoSystems; 42-03 35th Street, Long Island City, NY 11101. Tel: (718) 729-2020 ext 1901

2.01 ALTERNATE APPROVED MANUFACTURERS:

1. MechoShade Systems, Inc. www.mechoshade.com
2. BTX Window Automation, Inc. www.btxinc.com
3. Hunter Douglas 800-727-8953 www.hunterdouglas.com
4. Lutron Shading Solutions by VIMCO www.lutron.com/shadingsolutions
5. Sol-R-Veil www.solrveil.com
6. Houston Window Fashions, Inc.
7. Substitutions: Section 01 25 13 - Product Substitution Procedures.

2.02 COMPONENTS

A. Shade Band Material: acrylic-coated fiberglass or polyester.

1. Material Width: As required to eliminate or minimize vertical seams.
2. Bottom Hem: Straight.
3. Material Openness Factor: 0 percent (blackout).
4. Material Color: As selected from manufacturer's standard colors.

B. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for one roller shade band per roller, unless otherwise indicated on Drawings.

C. Direction of Roll: Regular, from back of roller.

D. Mounting Brackets: Fascia end caps, fabricated from steel finished to match fascia or head box.

E. Pocket with Ceiling Slot Opening: Six-sided box units for recessed installation; fabricated from formed -steel sheet, extruded aluminum, or wood; with a bottom consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an operable, continuous metal access panel concealing rollers, brackets, and operating hardware and operators within.

F. Mounting: Recessed in ceiling pocket mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

1. Provide complete matching metal fascia and endcaps or ceiling/wall headbox assembly to cover unit hardware and shade roller for flush or surface mounting (not in pocket)

G. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide exposed to view, external-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.
1. Shade Operation: Motorized operator.

2. Operating Function: Stop and hold shade at either fully open or fully closed positions.

2.03 FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: No corrodible or corrosion-resistant-coated materials.
1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 114 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Colors of Metal and Plastic Components Exposed to View: As indicated by manufacturer's designations, unless otherwise indicated.

2.04 MOTORIZED ROLLER SHADE OPERATORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Manufacturer of roller shade.
2. Elero USA Inc.
3. SIMU US, Inc.
4. SOMFY Systems.
5. DEL Motorized Solutions

B. General: Provide factory-assembled motorized shade operation systems designed for lifting shades of type, size, weight, construction, use, and operation frequency indicated. Provide operation systems of size and capacity and with features, characteristics, and accessories suitable for Project conditions and recommended by shade manufacturer, complete with electric motors and factory-prewired motor controls, remote-control stations, remote-control devices, power disconnect switches, enclosures protecting controls and all operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with the building electrical system.

C. Comply with NFPA 70.

D. Control Equipment: Comply with NEMA 1CS 1, NEMA 1CS 2, and NEMA ICS 6.

E. Electric Motors: UL-approved or recognized, totally enclosed, insulated motor, complying with NEMA MG 1, with thermal-overload protection, brake, permanently lubricated bearings, and limit switches; sized by shade manufacturer to start and operate size and weight of shade considering service factor or considering Project's service conditions without exceeding nameplate ratings.
1. Service Factor: According to NEMA MG 1, unless otherwise indicated.
2. Motor Characteristics: Single phase, 110 V, 60 Hz.
3. Motor Mounting: Within manufacturers standard roller enclosure.

F. Position of Motor and Electrical Connection: Left or right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated.

G. Remote Controls: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following devices for remote-control activation of shades:
   1. Group Control Stations: Keyed, momentary-contact, three-position, switch-operated control station with open, close, and off functions for single switch group control of all shade units on each wall. Provide two keys per station.

   2. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop shade at fully raised and fully lowered positions.

H. Operating Function: Stop and hold shade at any position.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive work.

B. Verify structural blocking and supports are correctly placed.

3.02 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.03 ERECTION TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

B. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.

B. Adjust blinds for smooth operation.

3.05 CLEANING

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

D. Clean blind surfaces just prior to occupancy.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades.

END OF SECTION 12 24 13

SECTION 12 24 15 MANUALLY OPERATED ROLLER WINDOW SHADES

PART 1 GENERAL

1.01 SUMMARY

A. Provide manually operated, 0% to 8% open sunscreen cloth and/or blackout cloth roller shades as applicable.

1.02 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal requirements.

B. Shop Drawings: Indicate opening sizes, tolerances required, method of attachment, clearances, and operation.

1. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.

C. Product Data: Submit data indicating physical and dimensional characteristics, operating features, and finishes.
1. Include operating instructions.

2. Preparation instructions and recommendations.

3. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.

4. Storage and handling requirements and recommendations.

5. Mounting details and installation methods.

D. Samples: Submit two samples, 12 x 12 inches in size, of shade material.
1. For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shade cloth samples and aluminum finish sample as selected. Mark face of material to indicate interior faces.

E. Manufacturer's Installation Instructions: Submit special procedures, and perimeter conditions requiring special attention.

F. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

G. Warranty: Provide manufacturer’s warranty documents as specified

1.03 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Flame-Resistance Ratings: Passes NFPA 701-99.

B. Product Standard: Provide roller shades complying with WCMA A 100.1.

C. PVC-Free Shadecloth: Comply with the following.

1. Shadecloth Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, and ATCC9645.

2. Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified below. Initial submittals, which do not include the Environmental Certification, below will be rejected. Materials that are simply 'PVC free' without identifying their inputs shall not qualify as meeting the intent of this specification and shall be rejected.

3. Third Party Evaluation: Provide documentation stating the shade cloth has undergone third party evaluation for all chemical inputs, down to a scale of 100 parts per million, that have been evaluated for human and environmental safety. Identify any and all inputs, which are known to be carcinogenic, mutagenic, teratogenic, reproductively toxic, or endocrine disrupting. Also identify items that are toxic to aquatic systems, contain heavy metals, or organohalogens. The material shall contain no inputs that are known problems to human or environmental health per the above major criteria, except for an input that is required to meet local fire codes.

1.04 MOCK-UP

A. Provide a mock-up, if Architect requires, of one roller shade assembly for evaluation of mounting, appearance and accessories. Locate mock-up in window designated by Architect. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.05 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

B. Installer: Company specializing in installing products specified in this section with minimum three years experience and approved by manufacturer.

1.06 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.07 COORDINATION

A. Section 01 31 00 – Project Management & Coordination: Coordination and project conditions.

B. Coordinate the Work with window installation and placement of concealed blocking to support blinds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver components in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

1.09 PROJECT CONDITIONS

A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 WARRANTY

A. Warranty: Provide manufacturer's standard warranties, including the following:

B. Roller Shade EDU's and EDU Control Systems: Manufacturer's standard non-depreciating five-year warranty.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Basis of Design: Manufacturer for Window Shade System: products by MechoSystems; 42-03 35th Street, Long Island City, NY 11101. Tel: (718) 729-2020 ext 1901

2.01 ALTERNATE APPROVED MANUFACTURERS:

1. MechoShade Systems, Inc. www.mechoshade.com
2. BTX Window Automation, Inc. www.btxinc.com
3. Hunter Douglas 800-727-8953 www.hunterdouglas.com
4. Lutron Shading Solutions by VIMCO www.lutron.com/shadingsolutions
5. Sol-R-Veil www.solrveil.com
6. Houston Window Fashions, Inc.
7. Substitutions: Section 01 25 13 - Product Substitution Procedures.

2.02 COMPONENTS

A. Shade Band Material: acrylic-coated fiberglass or polyester. Provide 3% open screen unless otherwise selected.

1. Material Width: As required to eliminate or minimize vertical seams.
2. Bottom Hem: Straight.
3. Material Openness Factor: 0 percent to 5% as selected.
4. Material Color: As selected from manufacturer's standard colors.

B. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with manufacturer's standard method for attaching shade material. Provide capacity for one roller shade band per roller, unless otherwise indicated on Drawings.

C. Direction of Roll: Regular, from back of roller.

D. Mounting Brackets: Fascia end caps, fabricated from steel finished to match fascia or head box.

E. Pocket with Ceiling Slot Opening: Six-sided box units for recessed installation; fabricated from formed -steel sheet, extruded aluminum, or wood; with a bottom consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an operable, continuous metal access panel concealing rollers, brackets, and operating hardware and operators within.

F. Mounting: Recessed in ceiling pocket mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.
1. Provide complete matching metal fascia and endcaps or ceiling/wall headbox assembly to cover unit hardware and shade roller for flush or surface mounting (not in pocket)

G. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide exposed to view, external-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

H. Shade Operation: Manual, chain driven

2.03 FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.

B. Concealed Components: No corrodible or corrosion-resistant-coated materials.
1. Lifting Mechanism: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F:
1. Shade Units Installed between (Inside) Jambs: Edge of shade not more than 114 inch from face of jamb. Length equal to head to sill dimension of opening in which each shade is installed.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting fascia, roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Colors of Metal and Plastic Components Exposed to View: As indicated by manufacturer's designations, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

B. Verify openings are ready to receive work.

C. Verify structural blocking and supports are correctly placed.

3.02 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.03 ERECTION TOLERANCES

A. Section 01 40 00 - Quality Requirements: Tolerances.

B. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch.

C. Maximum Offset From Level: 1/8 inch.

3.04 ADJUSTING

A. Adjust blinds for smooth operation.

3.05 CLEANING

A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.

B. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

C. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

D. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

E. Clean blind surfaces just prior to occupancy.

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades.

END OF SECTION 12 24 15

SECTION 12 32 16 MANUFACTURED PLASTIC LAMINATE CLAD CASEWORK

PART 1 - GENERAL

1.01 SCOPE

A. Furnish and install all casework, tops, fillers and accessories. Refer to drawings for casework locations, type, and dimensions. Furnish submittals and shop drawings.

1.02 QUALITY ASSURANCE

A. Standards: All units specified or scheduled herein shall conform to the "Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program, Division 400A, "Architectural Cabinets"; Division 400B, "Laminate Clad Cabinets"; and Division 400C, "countertops"; CUSTOM GRADE as published by The Architectural Woodwork Institute, except as modified by specific requirements of this specification section. Any reference to Premium, Custom or Economy in the specification shall be as defined in the latest edition of the AWI "Quality Standards."

B. Competence: The approved plastic laminate casework manufacturer must have a reputation for doing satisfactory work on time and shall have successfully completed comparable work during the past 5 years. Manufacturers seeking approval to bid shall submit evidence prior of approval to bid that their product meets the above quality standards and shall show evidence of adequate plant, equipment, manpower, and experience to produce the quality of casework specified and delivered on schedule.

1.03 SUBMITTALS

A. Shop Drawings: Submit in accordance with Section 01 33 00. Indicate materials, species, construction, sizes, shapes, quantities, location and conditions of adjoining work.

1. Sheet size shall be 8-1/2" x 11" but no larger than 24" x 36" with all sheets of the same size.

2. Drawings shall show all sizes, component and component thicknesses, quantities, markings, materials, finishes and installed hardware. Drawings shall show plans, profiles, sections and views of items manufactured for this work. Plan drawings shall be no smaller than ¼" = 1'-0"; elevation drawings shall be no smaller than 3/8" = 1'-0"; connection details shall be no smaller than 3" = 1'-0".

3. Make assembly and installation drawings to show methods of fastening, bracing and connecting to work of other trades.

4. Note and mark drawings sufficiently to indicate compliance with the requirements of the referenced standards and of these specifications.

B. Submit MSDS for each composite wood or agrifiber product with urea – formaldehyde resin limits highlighted.

C. Samples: Submit samples of laminated plastic from approved manufacturer and each species of solid wood and plywood for Architect's selection and approval. Identify each sample species, cut, and grade. Submit samples of miscellaneous hardware if requested by Architect. Submit finished samples of each finish to be applied at factory.

D. Field verify dimensions of cabinet locations prior to fabrication. Coordinate Owner furnished kitchen equipment sizes with Owner and include in shop drawings when submitted to Architect.

E. Care shall be taken to confirm that all clearances, reach ranges and mounting heights meet Texas Disabled Accessibility Standards. Conflicts between these standards and contract documents shall be submitted to Architect for clarification with shop drawings. Any revisions to casework after installation shall be the responsibility of the installer at no additional cost to the Owner or Architect. Confirm age group served with the Architect prior to submitting shop drawings.

1.04 WARRANTY

A. Provide manufacturer's written warranty guaranteeing all materials and workmanship for a period of one year from date of project Substantial Completion. Defects reported within the guarantee period will be promptly corrected without charge to the owner.

1.05 FIELD DIMENSIONS

A. The woodwork manufacturer is responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings all required field measurements beyond his control. The general contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

1.06 DELIVERY

A. The casework manufacturer and the contractor shall be jointly responsible to make certain that casework is not delivered to job site until the building and storage areas are sufficiently dry so that the casework will not be damaged by excessive changes in moisture content. Deliver, store, and handle millwork in a manner to prevent damage and deterioration. Maintain relative humidity in storage areas so that the woodwork will not be damaged by excessive changes in moisture content

B. Contractor shall be responsible for protection of finished work from soiling, staining, damage, painting and abuse and shall replace any damaged work without additional cost to the owner.

1.07 ENVIRONMENTAL

A. Any plywood or particle board used that contains formaldehyde shall be sealed using laminated plastic or two (2) coats of formaldehyde sealer such as "Right On" for maximum emission rate of .07 ppm.

PART 2 - PRODUCTS

2.01 APPROVED CASEWORK MANUFACTURERS

A. Ameritek Design, Inc., Houston, TX (281) 442-7767; www.ameritekdesign.com
B. Calmar Mfg. Co., Inc., Calmar IA (563) 562-3261; www.imperialwoodworking.com
C. Case Systems, Inc., Houston, TX (281) 717-8528; www.casesystems.com
D. Global Casework Mfg., Inc., Sugarland, TX (281) 494-9300; www.globalcasework.com
E. Jericho Woodworks, Stafford, TX (281) 969-7947; www.jericho-woodworks.com
F. Jim R. Reynolds Associates, Inc. Houston, TX (281) 350-1133; www.jimreynolds.com
G. LSI Casework of America, Inc., Minneapolis, MN (763) 559-4664; www.lsicasework.com
H. MGC Millwork, LP, Houston, TX (713) 800-7300; www.mgcinc.net

I. Robert Shaw Mfg. Co., Inc., Ft. Worth, TX (817) 927-2557; www.robertshawmfg.com
J. Stevens Industries, Inc., Teutopolis, IL (217) 540-3100; www.stevensind.com
K. JC Millwork, Flower Mound, TX 75028; (469) 702-2570; www.jcmillwork.com
L. TMI Systems Design Corp., Dickenson, ND (701) 456-6717; www.tmisystems.com

2.02 MATERIALS

A. Laminated Plastic – General Use: Laminated plastic shall be high-pressure type conforming to NEMA standards #LD3-2005.. Plastic sheets shall be laminated to plywood, under pressure, with adhesive recommended by the manufacturer. All laminated parts must be balanced with materials as listed below:

1. Approved laminate manufacturers:

a. Wilsonart International
b. Nevamar Decorative Surfaces (Panolam Industries)
c. Formica Corporation
d. Abet Laminati
e. Pionite
f. Arborite

2. Blending of laminate across multiple cabinet faces in one elevation: Continuous pattern material permitting. **Interior laminate at all open shelving to match exterior cabinet body laminate.**

3. Direction and matching of wood grain or pattern on individual cabinet: Continuous vertical figure across doors and drawer fronts and selection for pleasing blend of figure and color per elevation.

4. Semi-exposed parts (not including drawer bodies and backs of flush doors): High pressure laminate (Nominal 0.7 mm [.028”] thick) or thermoset decorative overlay, solid color or nominal 0.5 mm [.020”] cabinet liner on MDF

5.

Exposed Vertical surfaces (doors, cabinets, etc.-General Purpose)	.028”+/- .004)
Tops (square edges – General Purpose)	.048” (+/- .005)
Tops (post formed)	.039” (+/- .005)
Cabinet liner (concealed surfaces)	.020” (+/- .004)

B. The following shall apply to PVC or self-edged cabinet parts:

1. All edges must be banded

2. All visible casework edges shall be edged with PVC or HPDL edge banding. Back edges and ends of adjustable shelves within cases are not considered to be visible.

a. Leading edge of shelves behind cabinet doors – 1 MM PVC banding
b. Leading edge of shelves at open shelving – 3 MM PVC banding
c. Edges of all doors and drawers – 3 MM PVC banding
d. Leading edge of all PVC countertops – 3 MM PVC banding

3. Hot melt applied HPDL edge banding shall be primed before application for proper adhesion unless the hot melt adhesive used has been specifically formulated for the application of HPDL without requiring pre-application of a primer.

4. Edgebands, to the extent of standard length materials, run the full length of a single vertical or horizontal member without a joint or splice. Edges of the band are trimmed flush with, and align with, the plane of the case body to which they are applied.

5. NOTE: Edgeband or chamfer the lower edge of a die wall toe kick.

C. FLUSH CABINET DOORS AND DRAWER FRONTS

1. Laminate shall be applied to both faces in the same machine direction

2. NOTE: Laminate face side and thermoset decorative overlay back side not permitted.

D. DRAWER SIDES AND BACKS

1. Shall be single species solid lumber with a Section 100-G-1 hardness rating of Medium or better (minimum 12.7 mm (1/2" finished thickness). Drawer Sides, Backs, and Bottoms: Shall be sealed, sanded and resealed with a two-coat conversion varnish. Drawer suspensions shall be securely screwed to drawer sides, cabinet ends and partitions. All drawers shall be provided with rubber bumpers and positive stops. Stops will interact between the back or side of the drawer and the side of the cabinet.

E. DRAWER BOTTOM

1. Shall be min. ¼" nominal thickness, veneer core panel product, "B" face hardwood veneer. Install bottom by means of standing shoulder joint – 4 sides of drawer body.

F. DRAWER FRONT

1. Provide separate (finished face) drawer front (3/4" min. thick). Drawer body front to be ½" min. thickness.

2. Drawer front and door edges to have 3mm PVC edges

G. DRAWER CONSTRUCTION TECHNIQUES/SUPPORTS

1. Acceptable techniques:

a. Glued dovetail or multiple-dowel joints.

b. All joints shall be lock shoulder, glued and pin nailed

H. CONCEALED 35mm CUP HINGE INSTALLATION REQUIREMENT

1. When 35 mm cup hinges are used, plastic insertion dowels to receive the screws of the hinge and 5 mm "Euroscrews" to attach the baseplate are required.

2. NOTE: The attachment of hinge bodies to fiberboard doors with wood screws without insertion dowels is not acceptable.

3. Doors over 48" high require a minimum of three hinges. Doors over 66" high require a minimum of four hinges. In hinging doors, drilling of pilot holes and the use of full

2.03 COMPONENT MATERIALS

A. COMPONENT MATERIAL – All components to be ¾" thick unless noted otherwise.

1.	Casework body members	MDF
2.	Rails	MDF or solid lumber
3.	Shelves to 36" long	MDF
4.	Shelves 36" to 42" long	1" min. thick MDF
5.	Drawer fronts	MDF
6.	Drawer sides, backs, sub-fronts	MDF or solid lumber
7.	Drawer bottoms	standard hardboard
8.	Hinged cabinet doors (30" x 66" max.)	MDF
9.	Hinged cabinet doors (36" x 78" max.)	MDF
10.	Countertops (square edge)	MDF
11.	Countertops (post formed)	MDF

B. Metal Parts: All metal parts, table legs, table frames, etc. shall be furniture steel fabricated by welding, then degreased, cleaned, treated, and painted or chrome plated.

C. Hardware: All hardware shall be heavy duty institutional type and shall consist of:

1. Hinges: Dull chrome plated steel, five knuckle hospital tip .095 gauge. All hinges shall be wrap-around type which allows 270" swing at end of unit and shall be attached with plated tapping screws. Three hinges required for doors over 48" and under 66" high. Full height (66" or taller) cabinet doors to receive 2 pairs of hinges.

   a. Concealed Hinges (provide where indicated in the drawings); Concealed 35mm hinges shall be equal to Blum 71B3750 or Blum 71B3550 with 110 degree opening angle.

2. Pulls: Standard pulls shall be extruded aluminum semi-elliptical design with 4" hole center spacing. Pulls shall be attached with two #10-24 plated machine screws. Finish to be brushed and lacquered.

3. Drawer Slides/Suspensions: All drawers shall be equipped with one pair of cold rolled steel, zinc plated, ball beating roller suspensions with the following load capacity:

   a. Drawer Slides for Heavy Duty Drawers

      1) Drawers 24" wide or less shall be equal to Accuride 4034 all ball bearing slide, with rail mount, hold-in detent, full extension + 1.5 in. over travel, 150 lbs load rating and progressive movement. Standard finish – clear zinc.

      2) Drawers 42" wide or less, drawer width of a standard 4 foot case section shall be equal to Accuride 3640A all ball bearing slide, with rail/bracket mount, hold-in detent, full extension + 1 in. over travel, 200 lbs load rating and progressive movement. Standard finish – clear zinc.

      3) Drawers 42" wide or less, shall be equal to Accuride 7957 all ball bearing slide, with full extension, handed lever disconnect and 300 lbs load rating. Standard finish – clear zinc

b. Keyboard Tray (if required or shown on drawings)

1) Keyboard Tray with adjustable tilt plate shall be equal to Accuride "CBERGO-TRAY300" all ball bearing, full extension slides with three position detent and an integral keyboard tray including gel palm rest, storage compartments, cable management and mouse pad.

OR

1) Where keyboard drawers are noted on the drawings, provide pull-out/down keyboard drawer at locations noted equal to Model SD-1 as manufactured by Knape & Vogt. Drawer to include mechanism with knob adjustment to adjust height and tilt, 18" easy-glide track, platform without palm rest for standard style keyboards and non-skid surface pads to keep keyboard stationary.

4. Door Catches: All door catches shall be heavy duty magnetic type, minimum 7 pound pull, attached with screws and slotted for adjustment.

5. Assembly Clips: All case assembly clips shall be steel stud and spring clip type for tight joints and completely concealed fastenings. Clips and studs to be heavy duty type with a rust preventive finish.

6. Shelf Standards (recessed mounted): Shall be heavy duty, recessed mounted aluminum K & V #255. **On all open shelf units, front shelf support standard to be mounted a maxium of 1 ¼" back from cabinet face. NO EXCEPTIONS**.

7. Shelf Supports: Spring lock designed metal support, K & V #256 for installation in K-V supports and standards. Supports shall be located in a manner which prevents accidental removal; four supports per shelf.

8. Locks: Provide where shown in the drawings. Locks shall be vertical deadbolt, 7-pin tumbler. Locks on cabinets in same room keyed alike. Provide two (2) keys per room where doors and drawers are scheduled to receive locks. Dull chrome finish. Lock core shall be removable with a control key, permitting Owner to change lock arrangements without tools. Each classroom shall be keyed separately key from other classrooms.Match Owner's existing master keying system.

9. Nameplates for Mailboxes: Provide metal nameplate (label holders) at the bottom of each mailbox equal to 60mm x 17mm (2 3/8" x 11/16"), suitable for slide-in labels.

D. Mirrors: All mirrors shall be ¼" thick polished mirror plate attached with plastic clips and screws. Provide 10" x 12" mirror at each teacher wardrobe unit. Provide other sizes and locations as indicated in drawings and details.

E. Coat Rods: All coat rods shall be 1" diameter round plated steel tube. Provide one at each teacher's wardrobe unit with closet section.

F. Installation Hardware: All installation type hardware shall be furnished by the installer. Such hardware includes wall or floor anchors, screws for joining adjacent cabinets, and top fasteners.

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Base Cabinets: Ends shall be full height and notched to receive a toe space rail. Top and bottom shall butt joint end and be secured in placed with concealed assembly clips and studs. All fixed interior components, dividers, cubicles, etc., shall be machine fitted to close tolerance and attached with concealed steel case assembly clips and studs.

1. **Provide 2x treated solid lumber bases for all base cabinets, tall cabinets and any other floor mounted cabinet. Laminate is not required on the treated base. Wood bases to be wrapped with rubber base.**

B. Doors: All doors shall be laminated 032" thick laminate on exterior side and .030" thick cabinet liner on interior side. Doors shall be sized to allow a 1/4" reveal at cabinet top, bottom, and ends. Spacing between cabinet doors and/or drawer shall be 1/8".

C. Drawer Bodies: Construct drawers to maximum depth for case body in which they are housed. Drawer width and height as shown on the drawings. Drawer box shall be sealed, sanded and resealed with a two-coat conversion varnish.

D. Shelves: Adjustable shelves to be laminated on two sides with .030" thick cabinet liner and shall be self-edged with plastic laminate using hot melt glue. Shelves shall be supported by means of four metal clips and shall be adjustable on 1-1/4" centers. Fixed shelves to 36" long shall be laminated on two sides with .030" thick cabinet liner and shall be self-edged with plastic laminate. Shelves shall be attached to cabinet ends or partitions by means of concealed assembly clips.

E. Countertops:

1. Square Edges: Laminated plastic countertops shall be ¾" thick moisture resistant MDF cores faced with laminated plastic. All tops shall include square front edge and coved integral 4" height back splashes and square end splashes if cabinet butts wall. Refer to drawings and details for countertop construction.

2. Post Formed **(provide at ALL tops with sinks or lavatories)**: Laminated plastic countertops shall be ¾" thick moisture resistant MDF cores faced with laminated plastic post formed with radius front edge and one-piece rolled 4" height cove splash. Provide square edge splashes where cabinet butts wall or tall cabinets. Refer to drawings and details for countertop construction.

3. Chemical Resistant: Tops shall be 1-1/4" thick overall as specified. Continuous tops shall have the joints secured with bolt-type fasteners let into the under side of the top. Back curbs shall be 7/8" thick overall, built up on top edge to 1-1/4" thickness to allow fitting to building walls. Curb shall be mounted to the read edge of top by means of concealed fasteners and shall be sealed before installed. End curbs shall be 1-1/4" thick overall and same as back curb.

4. Use colored caulking (as selected by Architect to match wall or countertops) to fill minor gaps between cabinet and countertop/splash to wall surfaces. Gaps over 1/8" are not acceptable and wall shall be reworked prior to placing cabinet and top/splash against wall. Tops shall be fastened to sub or web frames with concealed clips, screws, glue blocks, or similar hidden fastening. Install plastic laminate to surface with contact cement/adhesive as approved by laminate plastic manufacturer.

5. Grommets/Wire Manager: Provide holes in countertops with plastic grommets at ALL knee-space locations for electrical, telephone and data cabling. Grommets to be minimum 2-1/2" diameter with removable top equal to Model EDP3 as manufactured by Doug Mockett & Company (800) 523-1269, www.mockett.com or architect approved equal.

F. Mobiles: All mobile case construction shall consist of 1-Y2" thick bottom, keyed to ends, and assembled with 5/16" diameter plated stop bolts. Ends, backs, and dividers shall be 3/4" thick. Back or intermediate divider is machined to close tolerances and fitted to ends with concealed fasteners. All casters shall be of the heavy duty ballbearing type with nonmarking hard rubber tread, bright zinc plated. Provide four, 4" or 5" diameter swivel casters for each unit with locking brakes on two wheels. All shelves, vertical dividers, drawers, etc., shall be attached similar to those described under Base Cabinet.

1. Low Mobiles: Construction shall incorporate a 3/4" sub-top, and a 13/16" top.

2. High Mobiles: Construction shall incorporate a 1-1/2" thick finished top, assembled to the ends with 5/16" diameter plated step bolts.

G. Wall Cabinets: All wall cabinets shall be similar in construction to base cabinets except all wall cabinet backs shall have a 3" anchor cleat the full width of the unit at the top and bottom. This cleat shall be secured in the rabbet over the back. Doors sized to allow 1/4" reveal at top and sides. Bottom edge of doors to align with bottom edge of ends. Wall cabinet exterior bottom shall have same plastic finish as exterior and shall show no exposed unfinished edges.

H. Tall Cases: Shall be similar in construction to base cabinets. Tops shall be flush with ends. Tops on cases less than 72" high shall be finished with exterior laminates. Doors shall be sized to allow a 1/4" reveal at all cabinet edges. Spacing between doors shall be 1/8" and pulls shall be centered vertically on doors. Finish back (exterior side) shall be laminated with .032" plastic on exterior side and .030" cabinet liner on interior side. Back panel shall be inset 3/16" and case ends shall be self-edged with plastic laminate. Back panel secured to case ends with concealed mechanical fasteners.

I. **Bases**: Bases shall be provided for all floor mounted units, continuous in groups. Base material shall be **TREATED 2 X 4 SOLID STOCK** attached together in varying lengths. Base material shall be covered with vinyl cove molding by General Contractor. Cabinets are secured and attached to the base itself. Individual bases shall be assembled complete with leveling shoes on all individual cabinets.

J. Finishes: Architect may select from standard colors and patterns from Formica, Pionite or Wilsonart. .

3.02 INSPECTION

A. Verify adequacy of backing and support framing.

3.03 INSTALLATION

A. Installation shall be made under the supervision of personnel experienced and competent in the classification or work.

B. Installation of groups of units shall be completed with continuous tops and bases.

C. Make all cutouts for electrical and plumbing fixtures furnished by others.

D. Set and secure casework in place rigid, plumb, and level.

E. Use purpose designed fixture attachments at concealed locations for wall-mounted components.

F. Use threaded steel concealed joint fasteners to align and secure adjoining cabinet units, countertops, and bases.

G. Carefully scribe casework which is against other building materials leaving gaps of 1/32" maximum. Do not use additional overlay trim for this purpose. Provide filler panels matching cabinet face to close all gaps larger than 1" between walls or base cabinets and between walls or base cabinets and adjacent walls or other surfaces.

H. Secure cabinet and counter bases to floor using appropriate angles and anchorages.

I. Countersink anchorage devices at exposed locations used to wall mount components and conceal with solid plugs of species to match surrounding finish. Finish flush with surrounding surfaces.

3.04 ADJUSTING AND CLEANING

A. Adjust doors, drawers, hardware, fixture and other moving or operating parts to function smoothly and correctly.

B. Clean casework, counters, shelves, hardware, fittings and fixtures.

END OF SECTION 12 32 16

SECTION 12 56 00 LIBRARY FURNITURE

PART 1 - GENERAL

1.01 SCOPE

A. Extent of wood library furniture as indicated on Drawings.
1. Provide and install manufactured library furniture as listed in the Attachment-A

1.02 REFERENCES

A. Architectural Woodwork Institute Quality Standards.

1.03 SUBMITTALS

A. Supplier must submit a sample section of shelving, showing the construction of the furniture exactly as it will be furnished. Supplier also must submit samples showing materials and construction proposed to be used on the job along with manufacturer's specifications and installation instructions for each type of library furniture. All samples must either meet or exceed the specified standards.

B. Submit 6" x 6" samples of each exposed finish required.

C. Submit shop drawings for each type of library furniture, showing details, dimensions, and layout of installation. Shop drawings must include rough-ins for wiring. Coordinate shop drawings with other involved.

D. Submit manufacturers installation instructions and recommendations.

E. All questions must be answered in detailed written form to remove confusion or doubt over what is to be provided.

F. Field verify dimensions of cabinet locations prior to fabrication. Coordinate Owner furnished library furniture sizes with Owner and include in shop drawings when submitted to Architect.

G. Care shall be taken to confirm that all clearances, reach ranges and mounting heights meet Texas Accessibility Standards. Conflicts between these standards and contract documents shall be submitted for clarification with shop drawings. Any revisions to casework after installation shall be the responsibility of the installer at no additional cost to the Owner or Architect. Confirm age group served with Architect prior to submitting shop drawings.

H. Submit filled-out "Product Data Form", included at the end of this section.

1.04 QUALITY ASSURANCE

A. It is the intent of these specifications to establish a minimum standard of quality acceptable to the owner for materials, hardware, finish, construction methods, design and function as well as craftsmanship of wood library furniture.

B. All work, material and equipment must be of the highest quality. All woodwork must be designed and finished to blend uniformly. In keeping with the highest standards of quality control and technical library furniture construction, careful detail must be given to the close matching of finish and veneers and all component parts.

C. Manufacturer must provide a minimum five-year warranty on all furniture included in this section.

D. Installer: Installation must be by the manufacturer's authorized representative and must conform to the manufacturer's standard procedure. Installer must have a minimum of five years documented experience installing library furniture.

E. Drawings and Specifications: Plans, elevations, details and specifications indicate components, material, fabrication, and similar design requirements for library furniture. Minor deviations will be accepted in order to utilize manufacturer's standard products when in Architect's sole judgment such deviations do not materially detract from design concept or intended performance.

F. The use of catalog numbers and specific requirements set forth in the drawings and specifications are given for purposes of establishing a minimum standard of design and quality for materials, construction and workmanship.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver library furniture only after all painting, wet work, grinding and similar operations are complete.

B. Do not deliver or install equipment until following conditions are met:
1. Windows and doors are installed and the building is secure and weather tight.
2. Ceiling, overhead ductwork and lighting are installed.
3. All painting is completed and carpet is installed.
4. Environmental Conditions: Building temperature must not exceed 80°F to avoid undue drying of materials used in wood furniture and subsequent damage by structural fatigue. Avoid frequent and /or excessive changes in temperature and or humidity levels during the course of the material installation or once materials are installed to prevent damage to equipment. Under no conditions should moisture levels exceed 60% relative humidity in order to avoid undue stress or splitting of wood materials.

1.06 WARRANTY

A. Provide written warranty signed by contractor, installer and manufacturer stating repair or replacement of units which fail in material or workmanship within the warranty period.

B. Warranty period: 2 years after date of Substantial Completion

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Units of the following manufacturers are acceptable, conditional to meeting all requirements of the design and specifications:
1. Basis of Design: Lone Star Furnishing; www.lonestarfurnishings.com
2. Tesco Industries; www.tesco-ind.com
3. Worden Co.; www.wordencompany.com
4. Brodart Company; www.brodart.com
5. Library Bureau; www.librarybureau.com
6. Russwood; Russwood Library Furniture

2.02 MATERIALS

A. Refer to drawings for layout and product types.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that the existing conditions are ready to receive work.

B. Beginning of installation shall mean that installer accepts existing conditions.

3.02 INSTALLATION

A. Install items in accordance with manufacturer's instructions and recommendations. Provide all hardware necessary to secure and install all items.

B. Allow for connection of electrical work. Coordination of all contractors involved is required.

C. Coordinate with related items such as blocking and furring.

D. All shelving and other furniture shall be carefully adjusted to the floor and leveled. Wall shelving shall be attached to the walls at the most inconspicuous locations and in a manner to ensure a secure attachment.

E. Install plumb, level true and straight with no distortions. Where equipment abuts other furnished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, top closures and moldings as indicated or required, and finish to match.

F. Anchor cabinets securely in place with concealed (when doors and drawers are closed) fasteners, anchored into structural support members or wall construction. Comply with manufacturer's instructions for support of units.

G. Complete hardware installation and adjust doors and drawers for proper operation.

H. Modular Shelving: install all adjustable shelves at equal spacing unless otherwise indicated.

3.03 CLEANING AND PROTECTION

A. Repair or remove and replace defective work as directed upon completion of installation. Verify that moving parts are operating freely.

B. Clean exposed and semi-exposed surfaces, polish all wood surfaces, touch-up as required or replace components as necessary to eliminate evidence of damage or deterioration.

C. Protection: Advise contractor of final protection and maintained conditions necessary to ensure that work will be without damage or deterioration at time of acceptance.

END OF SECTION 12 56 00

SECTION 12 93 13 BICYCLE RACKS

PART 1 - GENERAL REQUIREMENTS

1.01 SECTION INCLUDES

A. Provide and install bicycle racks as specified and at locations noted on the drawings.

B. Provide 3000 psi concrete footings as recommended by rack manufacturer.

1.02 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and other data needed to prove compliance with the specified requirement.

2. Manufacturer's installation instructions.

3. Manufacturer's maintenance instructions

B. Shop Drawings:
1. Indicate sizes and layout, method of attachment, accessories, trim, details and finish.

2. Samples or color charts of available finish showing manufacturer's full range of colors.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company specializing in and having minimum of five (5) years experience manufacturing products equivalent to those specified

B. Installer's Qualification: Manufacturer or company specializing in and having minimum of three (3) years experience installing products of type specified.

1.04 WARRANTY

A. Warrant the work specified for 5 years against becoming unserviceable or causing an objectionable appearance resulting from either defective or nonconforming finish, materials and workmanship.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS/MANUFACTURERS

A. Acceptable Manufacturers & Products:
1. Loop Style Bike Rack Tubing by Kay Park; 2-3/8” OD
a. 88” long
b. In ground mounted
c. Color: Architect to select from manufacturer’s full range of colors

2. Contemporary Loop Bike Rack by Belson Outdoors; 2-3/8” OD
a. Model 5807; 7'-3"W x 36"H*
b. In ground mounted
c. Color: Architect to select from manufacturer’s full range of colors

B. Substitutions: Refer to section 01 25 13

2.02 MATERIALS AND COMPONENTS

A. Rack to be manufactured using 1-1/2” diameter schedule 40 steel pipe with flange mount for mounting on concrete slab.

B. Rack to be hot-dipped galvanized after fabrication and supplied with thermo-plastic coated finish to reduce bicycle damage.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that areas are ready for installation of all items and bring unsatisfactory conditions to the attention of the Architect.

B. Do not start work until all unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install bike rack at locations noted on the drawings and in accordance with manufacturer’s recommendations for flange mounting condition.

3.03 ADJUSTING AND CLEANING

A. Fit, align, and adjust assemblies level and plumb; provide smooth operation.

B. Clean assemblies of dirt and grease.

END OF SECTION 12 93 13

PROJECT MANUAL
Volume 2 of 2

Prototype #2
Elementary School #38

LAMAR CISD

100% Construction Documents
December 12, 2024

CSP# 03-2025

Project No. 24-028

pfluger

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Houston, Texas 77046
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SECTION 00 01 01.1 **TABLE OF CONTENTS: ARCHITECT**

List of Specifications, As Prepared by:

pfluger

2 Greenway Plaza, Suite 460
Houston, Texas 77046
P: 713.222.1141

12-12-2024

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END OF SECTION 00 01 10.1

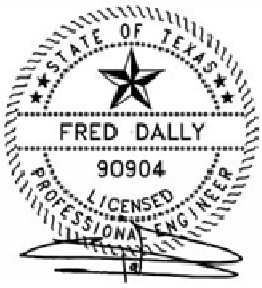
SECTION 00 01 10.2 **TABLE OF CONTENTS: CIVIL ENGINEER**

List of Specifications, As Prepared by:

CIVIL

DALLY + ASSOCIATES
9800 Richmond Ave Ste 460
HOUSTON, TX 77042
P: (713) 337-8881

END OF SECTION 00 01 10.2



12/12/2024

SECTION 00 01 10.3 TABLE OF CONTENTS: LANDSCAPE ARCHITECT

List of Specifications, As Prepared by:

LANDSCAPE

MARY GOLDSBY ASSOCIATES
112 NORTHWOOD STREET
HOUSTON TX 77009
P: (713) 802-2799

Mary Goldsby, PLA, ASLA

12-12-24

NUMBER TITLE

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List of Specifications, As Prepared by:

STRUCTURAL

MATRIX STRUCTURAL
5177 Richmond Ave Ste 670
HOUSTON, TX 77056
P: (713) 664-0130

Matrix Structural Engineers
TBPE Firm Registration No. F-2640

12/12/2024

NUMBER TITLE

END OF SECTION 00 01 10.4

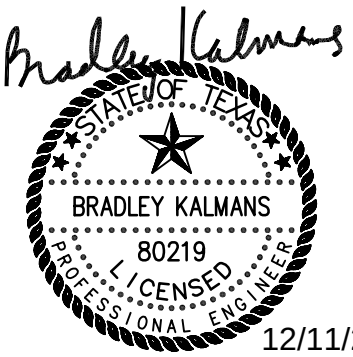
SECTION 00 01 01.5 TABLE OF CONTENTS: MEP ENGINEER

List of Specifications, As Prepared by:

MEPT

SALAS O'BRIEN

10930 W. Sam Houston Pkwy N. Suite 900
HOUSTON, TX 77064
P: (866) 768-4625



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END OF SECTION 00 01 10.5

SECTION 00 01 01.6 TABLE OF CONTENTS: TECHNOLOGY CONSULTANT

List of Specifications, As Prepared by:

MEPT

SALAS O'BRIEN

10930 W. Sam Houston Pkwy N. Suite 900

HOUSTON, TX 77064

P: (866) 768-4625

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SECTION 21 01 00 FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1"; Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11".
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.
6. Binder as specified.

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number.
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer
      2) Maintenance contractor as appropriate
      3) Identify area of responsibility of each
      4) Local source of supply for parts and replacement
   d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product
   b. Annotate each sheet to:
      1) Identify specific product or part installed
      2) Identify data applicable to installation
      3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:
      1) Relations of component parts of equipment and systems
      2) Control and flow diagrams
   b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
   c. Do not use Project Record Documents as maintenance drawings.
4. Written text, as required to supplement product data for the particular installation:

a. Organize in consistent format under separate headings for different procedures.
b. Provide logical sequence of instructions for each procedure.

5. Copy of each warranty, bond and service contract issued.
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure
      2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts
      1) Function, normal operating characteristics, and limiting conditions
      2) Performance curves, engineering data and tests
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine and normal operating instructions.
      2) Regulation, control, stopping, shut down and emergency instructions.
      3) Summer and winter operating instructions.
      4) Special operating instructions.
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting.
      3) Disassembly, repair and reassembly.
      4) Alignment, adjusting and checking.
      5) Routine service based on operating hours.
   d. Servicing and lubrication schedule. List of lubricants required.
   e. Manufacturer's printed operating and maintenance instructions.
   f. Description of sequence of operation by control manufacturer.
   g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Predicted life of part subject to wear.
      2) Items recommended to be stocked as spare parts.
   h. As installed control diagrams by controls manufacturer.
   i. Complete equipment internal wiring diagrams.
   j. Each Contractor's coordination drawings.
   k. As installed color coded piping diagrams.
   l. Charts of valve tag number, with location and function of each valve.
   m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
   n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 21.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide backflow preventer certified test reports.

END OF SECTION 21 01 00

SECTION 21 05 00 FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s seal, name, address and logo from drawings.
3. Mark documents RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY
5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
9. Exact location of all electrical equipment in and outside of the building.
10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
12. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required

to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.

B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
1. Provide the training during the Owner's regular working day.

2. The instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

B. Time to be allocated for instructions.
1. Minimum of 4 hours dedicated instructor time.
2. 2 hours on each of 2 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
1. One copy to the Owner.
2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
1. Designation approved by Architect/Engineer.
2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information

has been provided.

2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION 21 05 00

SECTION 21 05 10 FIRE PROTECTION CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
1. Field conditions.
2. Condition of installation.
3. Quality of workmanship.
4. Start-up of equipment.
5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION 21 05 10

SECTION 21 05 12 FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
1. Ductwork shop drawings

2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name and address
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
    a. Contractor
    b. Subcontractor
    c. Supplier
    d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 21 05 12

SECTION 21 05 13 ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
1. Motors for fire protection equipment.
2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
5. Pipe heat tracing.

C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.

D. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.

E. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for fire protection equipment manufactured by one of the following:
   1. Baldor Electric Company.
   2. Century Electric Div., Inc.
   3. General Electric Co.
   4. Louis Allis Div.; Litton Industrial Products, Inc.
   5. Lincoln Electric
   6. Marathon Electric Mfg. Corp.
   7. Reliance Electric Co.
   8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:

C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
   1. Frames. NEMA #56.
   2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
   3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
   4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
   5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect

coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION 21 05 13

SECTION 21 10 00 FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs, and any other component parts reasonably incidental to providing a complete protection system. Provide 100 percent coverage for the entire building.

B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.

C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.

D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.

E. Do not exceed 52,000 square feet of building for each individual sprinkler system.

F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20

G. It shall be the fire protection installer's responsibility to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure, and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.

H. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.

I. Study the general, structural, electrical, and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.

J. Provide a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in

NFPA 13. Refer to Architecture plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6'-0" o.c., minimum 6 inches and maximum 12 inches from glazing.

1.2 BASIS OF DESIGN

A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.

B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

1.3 QUALITY ASSURANCE

A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state, and federal fire authorities.

B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.

C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

1.4 SHOP DRAWINGS

A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.

B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.

C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.

D. Provide ¼ scale drawings to show the location of the water entry into building with all zone valves, and shut-off valves, with alarms and drains at this location. Prepare the sprinkler drawings under the work of this Section.

E. Submit samples of all sprinkler types for approval.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Johnson Controls (Tyco Fire Products)
   1. Gem/Grinnell
   2. Central
   3. Star Sprinkler

B. Automatic Sprinkler Company of America

C. Potter Roemer, Inc.

D. The Reliable Automatic Sprinkler Company

E. Viking Corporation

F. Victaulic Company of America

G. Globe Fire Sprinkler Corporation

2.2 PIPING AND FITTINGS

A. Above Slab Inside Building
1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
a. Schedule. 40, black steel pipe joined with rolled grooved fittings.

B. Underground within five feet of building. Provide ductile iron pipe, Class 200 conforming to ASTM, and ring-tite fittings. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.

C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.

D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance with the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.

2.3 SPRINKLER HEAD

A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice size.

B. All heads shall be UL listed and/or FM approved and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with “O” ring design shall not be acceptable.

C. Exposed areas:
1. Standard upright type with brass finish and escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
2. Tyco Model B, FRB, Globe Model GL-QR, GL-SR, or approved equal

D. Sidewall applications:
1. Horizontal sidewall type with brass finishes and chrome escutcheon.
2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
3. Tyco Model B, FRB, Globe Model GL-QR/SW, GL-SR/SW, or approved equal.

E. Suspended ceilings:
1. Adjustable drop-down deflector type concealed heads with manufacturer painted white cover plate with glass bulb fusible link. Provide temperature rating per NFPA 13 and UL/FM approvals.
2. Color of plate, selected by Architect
3. Tyco Series RFII; Series ELOC, Globe Concealed Models GL-QR/INCH, GL-SW/INCH and GL-INCH/ECLH or approved equal.

F. Dry sprinklers heads at freezers and coolers
   1. Tyco Model DS-1, DS-2, or approved equal.

G. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and listed heavy duty bolt on guards. Bulb type sprinklers will not be acceptable for these locations.
   1. Storage rooms with exposed structure.
   2. Gymnasiums.
   3. Mechanical and Electrical rooms.
   4. Below exposed stairs.
   5. Exposed structure areas.

H. Systems serving walk-n freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer's recommendation with respect to freezer ambient temperatures expected.

2.4 INSPECTOR'S TEST CONNECTION

A. Provide inspector's test connection as required by NFPA 13.
   1. Ductile iron module housing with combination sight glass, orifice, and bonnet assembly
   2. UL listed
   3. Victaulic No. 718
   4. Globe Model UTD
   5. Tyco, or approved equal

2.5 TAMPER SWITCH / SUPERVISORY SWITCH

A. Tamper switch on each valve
   1. Controlling or shutting off sprinkler system or any portion thereof.
   2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
   3. Switch shall be compatible with installed valve for standard mounting.
   4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

2.6 FLOW SWITCH

A. Vane type flow switch.
   1. Self-contained pneumatic, adjustable retard.
   2. Two, single pole, double throw switches.
   3. Red enamel tamper proof switch housing with flow paddle.
   4. Potter Roemer Model No. 6200 or approved equal.

2.7 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.8 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

2.9 DRY PIPE SYSTEM

A. General: Provide a UL listed, and FM approved dry pipe system in areas subject to freezing. System shall consist of a dry pipe valve, air compressor, fusible link type sprinkler heads and all associated trim and piping for a complete operating system.

B. Dry Pipe Valve: Rated for a working pressure of 175 psi, factory hydrostatic tested at 350 psi, supplied with all gauges, valves, strainer, electrical alarm switch, ball drip valve, and drip cup assembly, manufactured by Victaulic Model 756, Globe Model RCW.

C. Air Compressor: Oilless, permanently lubricated, pipe mounted, direct drive, complete with safety relief valve manufactured by Reliable Model A or approved equal. Size of air compressor is determined by volume of dry pipe system. Coordinate power requirement with electrical contractor. Coordinate all wiring required with Fire Alarm System.

D. If the dry pipe system is not used in conjunction with a wet pipe system containing the necessary check valves or backflow preventer, a check valve shall be installed in the dry pipe system at the connection to the water supply.

E. If the dry pipe system is not used in conjunction with a wet pipe system containing a control valve such as a post indicator (PIV) or outside screw & yoke valve (OS&Y), a PIV or OS&Y shall be installed in the system.

F. The dry pipe valve and pipe to the wet supply shall be protected from freezing.

G. Provide an automatic or manual compressed air system capable of restoring normal air pressure to a system in 30 minutes or less.

H. Provide an accelerator when system capacity exceeds 500 gallons.

I. Provide a water motor alarm or electric pressure switch.

J. Provide dry pipe valve trim and pressure gauges.

K. Dry pipe system shall be hydraulically calculated for the hazard being protected.

L. Provide dry pendent type sprinkler heads only when the piping and sprinklers are not in a heated area.

M. Provide a test drain valve sized per NFPA. An inspector’s test shall be provided at each system.

N. Slope all piping toward a drain per NFPA 13. A drain shall be provided at all low points.

O. The following accessories shall be provided where required:
1. Victaulic Series 756.
2. Viking Model E dry pipe valve with conventional trim.
3. Viking Model D-1 accelerators.
4. Globe Model RCW dry pipe valve with conventional trim package, and Model C Accelerator.

2.10 GASKETS

A. Use 1/16-inch-thick preformed synthetic rubber bonded.

2.11 COUPLINGS

A. Use listed rolled grooved mechanical couplings to engage and lock grooved, or shouldered pipe ends and to allow for some angular deflection, contraction, and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

2.12 VALVES

A. Use valves suitable for 175 psig WOG.

B. Valves to be UL listed and FM approved.

C. Valve Connections:
1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
2. Screwed ends for pipe sizes 2 inches and smaller.
3. Flanged ends for pipe sizes 2-1/2 inches and larger.
4. Solder or screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

D. Gate Valves:
1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal.

E. Check Valves:
1. Up to 2-inch, bronze, regrind bronze swing disk, solder, or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.
2. Over 2-inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, Globe Model RCV, or approved equal.

F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.

G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

H. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

2.13 ELECTRIC ALARM BELL

A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell, UL listed, red enamel steel, manufactured by Simplex, or approved equal.

2.14 GAUGES

A. Gauges shall be bourdon tube type with minimum 4-1/2-inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.

B. Gauges shall have ¼ inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.

C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.

D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.

E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.

F. Manufactured by:
1. Trerice Model No. 4500 Series
2. Ashcroft
3. Marsh
4. Weksler

2.15 SPARE SPRINKLER HEAD BOX

A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used) for emergency replacement. Provide sprinkler wrench.

2.16 ALARM CHECK VALVE

A. Provide UL listed check valve.
1. Variable for City Supplied systems pressure trim set.
2. Constant for Fire Pump Systems pressure trim set.
3. Tyco AV-1, Globe Model H, or approved equal.

2.17 WATER MOTOR ALARM

A. Provide a red enamel motor alarm for installation on exterior wall.
1. Tyco Model WMA-1, Globe Model WM, or approved equal.

2.18 SIAMESE FIRE DEPARTMENT CONNECTION

A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate lettered AUTO-SPKR.
1. Provide a 4" X 2-1/2" x2-1/2".
2. Potter-Roemer #5751

PART 3 - EXECUTION

3.1 DESIGN

A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.

B. Uniform discharge density design shall be based on hydraulic calculations using the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.

C. Friction losses in pipe will be based on a value of “C” = 120 in the Hazen and Williams formula.

D. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting, or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.

3.2 LOCATION

A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.

B. Locate heads as may be required for coordinated ceiling pattern, even through number of heads exceed minimum code requirements.

C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.

D. Install a water curtain sprinkler system along glazing to create a 1-hour rating, as outlined in NFPA 13. Refer to plans for locations. Water demand for water curtain shall be added to the ceiling sprinkler water demand at the point of connection, per NFPA 13. Sprinkler heads shall be spaced at 6’-0” on center, minimum 6 inches and maximum 12 inches from glazing.

E. Where glazing shall be installed in 2-hour fire rated assemblies, the Tyco Window sprinkler shall be utilized as outlined in the ICC Legacy report equivalency requirements. Any glazing requiring fire exposure protection shall also utilize the Tyco window sprinklers.

3.3 PREPARATION

A. Ream pipes and tubes, clean off scale, rust, oxide, and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.

B. Pipe beveled each end, per approved procedures.

C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

3.4 CONNECTION

A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.

B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.

C. Clamp cast iron water pipe at fittings with ¾ inch rods and properly anchor and support.

D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

3.5 COORDINATION

A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.

B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.

C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

3.6 SURFACE CONDITIONS

A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work of other trades and determine that work is complete enough to allow installation to begin. Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

3.7 INSTALLATION

A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.

B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.

C. Locate system drains and inspector’s test connections in utility rooms, mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.

D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain valve with brass cap and chain.

E. Locate outside alarms on wall of building and coordinate with Architect.

F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire Marshall and/or all other authorities having jurisdiction.

G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.

H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in ceilings.

I. Provide Easy-Flex or Flexhead Industries sprinkler hose fittings for each sprinkler head installation for hydraulically designed wet, pre-action, deluge, or dry pipe sprinkler connections per NFPA 13. Allow a 3” minimum bend radius per UL.

J. Install pipe markers to identify fire protection.

K. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.

L. Install valves with stems upright or horizontal, not inverted.

M. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed areas, per NFPA 13.

N. Install the complete fire sprinkler system in accordance with the approved shop drawings.

O. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire sprinkler system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler system pipes. Where pipes pass through concrete floors, furnish, and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.

P. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.

Q. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).

R. Do not install exposed piping below structure in public area.

S. Provide heat tracing and insulation on wet piping systems exposed to freezing when not installed in a heated space or installed by other acceptable methods of maintaining the piping from freezing. Installation of heat tracing and insulation shall be in accordance with the latest edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with Division 26.

3.8 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved adjustable ring type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved adjustable ring type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.

D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
4" & 5"	10	5/8
6" and above	10	3/4

3.9 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable ring type hangers shall be used for single pipe supports; Erico Model 115 NFPA UL/FM. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. All parts shall be zinc plated carbon steel, or galvanized.

3.10 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16-gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and airtight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.11 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge, and circulate.

3.12 FLUSHING AND TESTING

A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.

B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.

C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.

D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

3.13 EXCAVATING, TRENCHING, AND BACKFILLING

A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows, and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows, and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
1. Both sides of penetrations through walls, floors, and ceilings.
2. Close to valves or flanges.
3. Intervals on straight pipe runs not to exceed 50 feet
4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

3.15 TESTING AND ACCEPTANCE

A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.

B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

3.16 TRAINING

A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner's designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner's Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION 21 10 00

SECTION 22 01 00 PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1 inch; Maximum ring size: 3 inches.

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2 inch x 11 inch.
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.
6. Binder as specified.

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number.
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer.
      2) Maintenance contractor as appropriate.
      3) Identify area of responsibility of each.
      4) Local source of supply for parts and replacement.
   d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product.
   b. Annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:
      1) Relations of component parts of equipment and systems.
      2) Control and flow diagrams.
   b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
   c. Do not use Project Record Documents as maintenance drawings.
4. Written text, as required to supplement product data for the particular installation:
   a. Organize in consistent format under separate headings for different procedures.
   b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued.
   a. Provide information sheet for Owner's personnel, giving:

1) Proper procedures in event of failure.
2) Instances that might affect validity of warranties or bonds.

6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.

1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts.
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine and normal operating instructions.
      2) Regulation, control, stopping, shut down and emergency instructions.
      3) Summer and winter operating instructions.
      4) Special operating instructions.
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting.
      3) Disassembly, repair and reassembly.
      4) Alignment, adjusting and checking.
      5) Routine service based on operating hours.
   d. Servicing and lubrication schedule. List of lubricants required.
   e. Manufacturer's printed operating and maintenance instructions.
   f. Description of sequence of operation by control manufacturer.
   g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Predicted life of part subject to wear.
      2) Items recommended to be stocked as spare parts.
   h. As installed control diagrams by controls manufacturer.
   i. Complete equipment internal wiring diagrams.
   j. Each Contractor's coordination drawings.
   k. As installed color coded piping diagrams.
   l. Charts of valve tag number, with location and function of each valve.
   m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
   n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 22.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide backflow preventer certified test reports.
10. Provide gas piping pressure test reports.

END OF SECTION 22 01 00

SECTION 22 05 00 PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.

B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Plumbing work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (TDLR)
6. Texas Accessibility Standards (TAS Based on ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than three systems of comparable size and type that has served their Owners satisfactorily for not less than three years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain three sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (two sets are for the Owner's use and one set is for the Architect / Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s seal, name, address and logo from drawings.
3. Mark documents RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY
5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
6. Indicate exact location of all underground plumbing and flow line elevation.
7. Indicate exact location of all underground plumbing piping and elevation.
8. Indicate exact location of all underground electrical raceways and elevations.
9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
12. Exact location of all electrical equipment in and outside of the building.
13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
15. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the

relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for one year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit three copies of all certifications and test

reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit three copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each subcontractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
1. 4 inch high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around multiple pipe penetrations.

3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.

B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner two suitable tools for use with each type of fastener used.

C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
   1. Provide the training during the Owner's regular working day.
   2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 6 hours dedicated instructor training and six hours of demonstration for two people with video recording.
   2. Six hours on each of two days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
   1. One copy to the Owner.
   2. One copy to the Architect / Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.5 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect / Engineer.
   2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with ½ inch high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to

accuracy of location or complete information.

1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION 22 05 00

SECTION 22 05 10 PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
1. Field conditions.
2. Condition of installation.
3. Quality of workmanship.
4. Start-up of equipment.
5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION 22 05 10

SECTION 22 05 12 PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼ inch = 1 foot - 0 inch.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
1. Ductwork shop drawings
2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, ”Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name and address
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
   a. Contractor
   b. Subcontractor
   c. Supplier
   d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect/Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect/Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION 22 05 12

SECTION 22 05 13 ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
1. Motors for plumbing equipment.
2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
5. Pipe heat tracing.

C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.

F. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.

G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for plumbing equipment manufactured by one of the following:
1. Baldor Electric Company.

2. Century Electric Div., Inc.
3. General Electric Co.
4. Louis Allis Div.; Litton Industrial Products, Inc.
5. Lincoln Electric
6. Marathon Electric Mfg. Corp.
7. Reliance Electric Co.
8. Westinghouse Electric Corp.

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:

C. Temperature Rating. Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for ¾ hp and larger, and provide capacitor-start single-phase motors for ½ hp and smaller, except 1/6 hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide two separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
1. Frames. NEMA #56.
2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.
4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

2.2 EQUIPMENT FABRICATION

A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION 22 05 13

SECTION 22 05 15 PLUMBING EARTHWORK

PART 1 - GENERAL

A. Excavate and backfill for pipe trenches for underground piping, and excavate for structures installed as part of plumbing work.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavate trenches for underground piping to the required depth to ensure 2 foot minimum coverage over piping.

B. Cut the bottom of the trench or excavation to uniform grade.

C. Should rock be encountered, excavate 6 inches below grade, fill with bedding material and tamp well.

D. Lay out alignment of pipe trenches to avoid obstructions. Assure that proposed route of pipe will not interfere with building foundation before any cutting is begun. Should interference be found, contact the Architect/Engineer before proceeding.

3.2 BACKFILL

A. Backfill shall not be placed until the work has been inspected, tested and approved. Complete backfill to the surface of natural ground or to the lines and grades shown on drawings. Except where special materials are requested, use suitable friable soils from other excavation as backfill material. Do not use peat, silt, muck, debris or other organic materials. Deposit backfill in uniform layers and compact each layer as specified in Division 2.

B. Compacting Backfill. Place material in uniform layers of prescribed maximum thickness and wet or dry the material to optimum moisture content. Compact with power-driven tampers to the prescribed density. Place regular backfill in 8 inch maximum layers, loose measure. Compact to not less than 95 percent of maximum soil density as determined by ASTM D-698 Standard Proctor.

C. Restoration. Compact backfill, where trenching or excavation is required in improved areas such as pavements, walks, and similar areas, to a condition equal to the adjacent undisturbed earth, and restore surface of the area to the condition existing prior to trenching or excavating operation.

D. Provide 6 inch stabilized sand bed with 4 inch stabilized sand cover around each pipe.

3.3 DISPOSAL OF EXCESS MATERIAL

A. Remove excess excavation material or material unsuitable for backfill. Excess material can be spread on grade, or shall be removed from site as directed by the Owner/Architect.

END OF SECTION 22 05 15

SECTION 22 05 16 **EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES OUTSIDE BUILDING SLAB**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.

B. Refer to Instructions to Bidders for substitution of materials and products.

C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

A. Coordinating all excavating and backfilling for the underground storm sewer, sanitary sewer, water distribution lines, and all related appurtenances.

B. The extent of lines, excavation, and backfill shall be in conformance with the locations, lines, elevations and grades shown on the drawings prepared by the MEP Engineer.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. Earthwork

B. Water Distribution

C. Sanitary Sewer

D. Plumbing

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM) Use current edition.
1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

B. City Standards

C. Local Governing Agencies

D. Texas Health and Safety Code, Chapter 161, Subchapter Q, as amended by House Bill No. 1927.

1.5 WARRANTY

A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland cement per ton; mix in a mill-type mixer.

B. Sand: Clean, local sand

C. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, rocks or other debris.

PART 3 – EXECUTION

3.1 EXCAVATION

A. General:
1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
2. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
3. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the line placing operation to ensure a dry, firm bed on which to place the utility line.

B. Storm and Sanitary Sewer Trenches:
1. For pipe sizes less than 42 inches in diameter, the minimum trench width shall be outside diameter of pipe plus 18 inches.
2. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

C. Appurtenances:
1. Any overdepth excavation below appurtenances shall be refilled with cement-stabilized sand.

D. Water Line Trenches:
1. Water lines shall be at least two feet in depth from the top of proposed grade to the top of pipe.
2. Trench width for water lines shall be a minimum of the outside pipe diameter plus 18 inches.
3. Trenches shall be excavated to a depth of at least 6 inches below the barrel of pipe.

3.2 PIPE BEDDING AND BACKFILL

A. Storm and Sanitary Sewer Trenches:
1. The cement-stabilized sand bedding shall not extend from a point 6 inches below the bottom of the pipe to the level of the spring line. This material shall not be used after it loses its moisture content.
2. The cement-stabilized sand shall be thoroughly rodded after being placed in the trench.

3. Bedding, sewer pipe, and initial backfill over the pipe must be placed in a single day for any given portion of pipe. Initial backfill shall be placed to one foot above the top of pipe for earth backfill and 6 inches over the top of pipe for cement-stabilized sand backfill.
4. Remainder of trench backfill shall be placed the next day or later in 8 inch lifts.
5. Backfill shall be placed in uniform layers not to exceed 8 inches loose depth, and compacted to a minimum of 95 percent of Standard Maximum Density (ASTM D698).
6. Backfill, under pavement and to one foot from outer edge, shall b e cement-stabilized sand, up to one foot below subgrade elevation. Remainder of backfill to subgrade to be as specified in paragraph 5 above and stabilized where required.

B. Water Line Trenches:
1. Pipe bedding shall consist of 6 inches of clean sand placed before the pipe is laid.
2. After laying pipe and ensuring that the pipe is properly placed and supported by the sand bedding, clean sand backfill shall be placed to 6 inches above the top of pipe. The sand backfill shall be thoroughly rodded and tamped for compaction.
3. For water lines to be beneath the building and pavement and to one foot from the outer edge of pavement, the remainder of the trench backfill shall be clean sand placed in 6 inch lifts and compacted to 95 percent Standard Proctor.
4. For water lines not beneath the building and pavement or within one foot from the outer edge of pavement the remainder of the trench backfill shall be earth fill placed in uniform layers not to exceed 8 inch loose depth. Each lift shall be compacted to a minimum of 90 percent of Standard Density (ASTM D698) at the proper moisture content specified in the soils report for this project. All earth backfill shall be placed the next day or later after the pipe is laid.

C. Natural Gas Trenches:
1. Natural gas lines shall not be installed under slabs on grade unless pipes are sleeved and vented as per Section 22 63 11.
2. Natural gas lines shall not be installed in trenches with other utilities.

D. Utility Locators:
1. Provide metallic locator over all underground utilities, including irrigation piping, plumbing, control wiring, conduit, data, etc. Locator tape shall be a maximum of 12 inches below grade and centered over the utility(s).

END OF SECTION 22 05 16

SECTION 22 05 17 PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames

B. 14-gauge steel panels

C. Continuous fully concealed hinges

D. Flush screwdriver cam lock & cylinder lock for Owner selection

E. Prime coat finish

F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation

G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors

B. 16-Gauge stainless steel

C. 20-Gauge insulated sandwich-type door panel.

D. Two inch thick with fire rated insulation

E. Continuous fully concealed hinge

F. Automatic closing and latching mechanism

G. Knurled knob and recessed key operation for Owner selection

H. Interior latch release slide for opening from inside

I. Prime coat finish

J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor

B. MIFAB

C. Acudor

D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.

B. Installation shall be in accordance with the manufacturer's printed instructions.

C. Minimum size required:
1. 24 inch x 24 inch for plumbing multiple isolation valves and electrical related items in ceilings
2. 8 inch x 8 inch for plumbing for single isolation valve or shock arrestor

END OF SECTION 22 05 17

SECTION 22 05 19 PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

A. Division 22, Plumbing
1. Plumbing General Provisions
2. Pipe and Pipe Fittings, General
3. Valves, Strainers and Vents

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

A. Trerice

B. Taylor

C. Marsh

D. Weksler

E. Marshalltown

F. Weiss

G. Miljoco

2.2 PRESSURE GAUGES

A. Case and Ring: 4 inch type 304 stainless steel; liquid filled case with stainless steel bayonet ring.

B. Dial: White aluminum with black markings

C. Window: Clear acrylic

D. Tube: Phosphor bronze and forged brass socket.

E. Gauge accuracy: +/- 1 percent over operating range.

F. For pulsating service, provide impulse dampers.

G. Without flange for pipe mounting.

H. With flange for wall mounting.

I. Weiss Model: Domestic Water 4CTS LF (Lead Free) 0-100 PSI

2.3 THERMOMETER WELLS

A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction (Lead Free).

B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.

C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.

D. Wells shall be sized to extend a minimum of 50 percent into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

A. Die cast aluminum case with baked epoxy finish.

B. Adjustable angle 9 inch scale length.

C. Clear acrylic window.

D. Brass stem, length to match well.

E. Red reading organic spirit filled-in magnifying glass column.

F. White background with black figures and markings.

G. Brass stems and union connections (Lead Free).

H Accuracy: +/- 1 percent of scale range.

I. Range:
1. Hot water lines: 30 deg. F to 240 deg. F.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with drawing details and manufacturer's recommendations.

B. Provide a ball valve at each gauge (Lead Free).

C. Locate gauges and thermometers to be easily readable from the floor at a 5 foot-6 inch eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.

D. Install gauges in the following locations: across pumps, storage tanks, heat exchangers.

E. Install thermometer in the following locations: At storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, and hot water supply and return lines.
1. Hot water lines: 30 deg. F to 240 deg. F.
2. Tempered water valves 0 deg. F to 120 deg. F.

END OF SECTION 22 05 19

SECTION 22 05 23 VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Plumbing Valves

B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

A. Pressure Ratings:
1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450 deg. F.
2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.

B. Butterfly Valves
1. Butterfly valves shall conform to MSS-SP67.
2. Liners, inserts and discs shall be suitable for the intended service.
3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
4. All valves for domestic use must be lead free.

C. Thermal Balancing Valves (adjustable Temperature)
1. Adjustable thermal balancing valve used for automatic balancing of circulation circuits in domestic hot water systems. Modulates flow rate in each circuit so hot water temperature at fixtures remains constant.
2. Standards:
   a. NSF/ANSI/CAN 372 low-lead laws, as certified by ICC-ES
   b. NSF/ANSI/CAN 61, commercial hot water 180 deg. F. as certified by ICC-ES
   c. Meets codes IPC and UPC
3. Maximum Working Pressure: 230 psig
4. Body Material: DZR low-lead brass.
5. Connections: NPT female threaded
6. Hydraulic Seals: Peroxide-cured EPDM.
7. Adjustable Balancing Cartridge: Stainless steel and copper.
8. ABS Adjustable Knob: Temperature adjustment scale for manual setting and tamper-proof adjustment locking screw.
9. Factory Setting: 130 deg. F.
10. Outlet Temperature gauge: 2-inch diameter with optional dual-scale outlet, 30 to 180 deg. F.
11. Check Valve.
12. Isolation Ball Valves: Inlet and outlet low-lead brass.
13. Manufacturers:
   a. Caleffi
   b. ThermOmegaTech
   c. Viega

D. Thermal Balancing Valves (Fixed Temperature)
1. Static balancing valve with integral flow meter and site gauge, combined with built in

temperature gauge and check valve. Designed for balancing domestic hot water circulation systems.
2. Standards: NSF/ANSI/CAN 372 low-lead laws, as certified by ICC-ES.
3. Maximum Working Pressure: 150 psig.
4. Working Temperature Range: 14 to 230 deg. F.
5. Valve Body, Flow Meter Body and Headwork: DZR low-lead brass.
6. Ball and Flow Meter Springs and Bypass Valve Stem: Stainless steel.
7. Ball Control Stem: Brass, chrome plated.
8. Ball Seal Seat: PTFE
9. Control Stem Guide, Flow Meter Float, and Indicator Cover: Polysulfone
10. Built-In Direct Reading Flow Meter:
    a. Detachable bypass channel for cleaning or replacement.
    b. Memory sliding pointer providing flow rae memory indication.
11. Seals: Peroxide-cured EPDM
12. Ball/Magnet Flow Indicator: Sealed, isolated chamber, not in contact with system fluid to provide clear, accurate readings.
13. Outlet Temperature Gauge: 30 to 210 deg. F., 2-inch diameter dual-scale temperature gauge.
14. Insulation shell
15. Isolation Ball Valves: Inlet and outlet low-lead brass
16. Manufacturers:
    a. Caleffi
    b. Legend Valve & Fitting, Inc.
    c. TACO Comfort Solutions, Inc.

E. Ball Valves
1. Provide ball valves with:
    a. Blowout proof stem.
    b. Full size port, 316 stainless steel ball and stem.
    c. Cast bronze body.
    d. Threaded ends.
2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
3. Service rating:
    a. 150 psi saturated steam.
    b. 600 psi WOG.
4. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used.
5. All valves for domestic use must be lead free.

F. Valve Connections
1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
2. Thread pipe sizes 2 inches and smaller.
3. Flange pipe sizes 2-1/2 inches and larger.
4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.
6. Use press valves when using copper press systems.

G. Valve Operators
1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
2. When cocks and valves are furnished with square head stem:
    a. Provide one wrench for every ten cocks or valves sized 2 inches and smaller, minimum of two.
    b. Provide each cock or valve size 2-1/2 inches and larger with a wrench with setscrew.

3. Where butterfly valves are provided:
   a. Provide gear operators on valves 6 inches and larger.
   b. Where valves are located 7 feet or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5 feet above floor and hook to clips, arrange to clear walking space.
   c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4 inches and smaller.

H. Acceptable Manufacturers (All listed must be lead free):
1. Apollo
2. Crane
3. Dezurik
4. Jenkins
5. Keystone
6. Kitz
7. Milwaukee Valve
8. Nibco
9. Stockham

I. Check Valves
1. Bronze body, 2 inches and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection (Lead Free).
2. Iron body, 2-1/2 inches and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug (Lead Free).
3. Acceptable Manufacturers (All listed must be lead free):
   a. Apollo
   b. Keystone
   c. Kitz
   d. Milwaukee
   e. Mission Duochek
   f. Nibco

J. Backflow Preventer (All valves for domestic use must be lead free):
1. BFP-1 (2 inches and smaller) bronze body, reduced pressure zone type with two inline independent check valves with an intermediate relief valve, complete with two full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet. Provide air gap fitting with full size drain piped to nearest floor drain. Watts 909-QT-S-LF.
2. BFP-2 (2-1/2 inches and larger) stainless steel or FDA epoxy coated ductile iron reduced pressure zone type with two inline independent check valves with reverse relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on inlet. Provide air gap fitting piped full size to nearest floor drain. Apollo RP4ALF-YS or Watts 909-NRS-BB-S-LF.

K. Provide valves of same manufacturer throughout where possible.

L. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

M. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

N. Provide valve, seat and trim materials suitable for the intended service.

2.2 PIPE SYSTEMS STRAINERS

A. Body:
1. Bronze "Y" pattern or basket as shown on the drawings.
2. Line size.
3. Threaded strainer blow down port.
4. ASTM A #126 Class B Cast Iron Body.

B. Construction:
1. 2 inch size and smaller with screw connections rated 400 psi WOG.
2. Over 2 inch size with flanged connections, rated 125 psi WOG.

C. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2 inches.
2. With 0.045 perforations in piping systems 2-1/2 inches and 3 inches.
3. With 0.125 perforations in piping systems 4 inches and larger.

D. Start-up:
1. Provide an additional fine mesh disposable screen for use during start-up operations.
2. Remove after 30 days.
3. Attach to piping for Owner’s review.

E. Acceptable Manufacturers (All listed must be lead free):
1. Apollo
2. Crane
3. Keckley
4. Kitz
5. Mueller
6. McAlear
7. Muesco
8. Nibco
9. Zurn

2.3 VALVE SCHEDULE

A. Domestic Service
1. Gas shut-off service: UL approved for natural gas service.
   a. Nibco Ball Valve, full port through 1 inch: T-585-70-UL
   b. Nibco Ball Valve conventional port 1-1/4 inch through 3 inch: T-580-70-UL
   c. Resun 2-1/2 inch and larger: 143 - 1-UL
   d. DeZurick 2-1/2 inch and larger: Series 425 or 435
   e. Locking Type: Rockford ¾ inch and 1 inch PNP-400
      Mueller 1-1/4 inch through 4 inch: Lub-O-seal
   f. Conbraco Ball Valve, full port through 4 inch: 64-100 Series
   h. Milwaukee Full Port ¼ inch-2 inch
   i. Milwaukee Standard Port 2-1/2 inch & 3 inch
   j. Kitz Full Port 2 inch =- #68
2. Cold and Hot water service (all listed must be Lead Free):
   a. Nibco Ball Valve full port through 2 inch: T-585-66-LF
   b. Nibco Ball Valve 2-1/2 inch and 3 inch conventional port: T-580-66-LF
   c. Nibco Butterfly Valve 4 inch and larger: LD-2000 EDPM Gaskets
   d. Watts Ball Valve 4 inch and larger: G-4000-FDA
   e. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
   f. Kitz Full Port through 2 inch - #868M Lead Free
   h. Milwaukee Full Port ¼ inch-2 inch

i. Milwaukee Standard Port 2-1/2 inch & 3 inch
j. Apollo Ball Valve Full Port through 2-1/2 inch 77CALF
k. Apollo Ball Valve Standard Port 3 inch 70LF
l. Apollo Butterfly Valve 4 inch and Larger LD141
m. Apollo Press Bronze Ball valves – 77 WLF

3. Check Valve (All listed must be Lead Free):
   a. Nibco Check Valve: T - 413 - Y -LF (Teflon Seats)
   b. Nibco Check Valve 2-1/2 inch and larger: F - 918 – Y -LF (Buna-N disc.)
   c. Nibco Check Valve 2-1/2 inch and larger: W - 920 -W-LF (Wafer)
   d. Kitz Y & Check: A-22T
   e. Kitz 2-1/2 inch and Larger #778 C.I.
   f. Kitz Wafer Check 2-1/2 inch and Larger #7032
   g. Milwaukee Valve – 509T
   h. Apollo Check Valve: 163TLF
   i. Apollo Check Valve 2-1/2 inch and larger: 910FLF
   j. Apollo Press Check Valve: 163TPR-LF
   k. Apollo Check Valve 2 inch and larger 910WE-LF (Wafer)

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.

C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.

D. Use butterfly valves and ball valves in circulating water systems, for balancing duty.

E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
   1. 1 inch valve for pipes 6 inch and larger.
   2. 3/4 inch valve for pipes smaller than 6 inch.
   3. Terminate with pipe plug.
   4. Drain valves shall be ball valves.

F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.

G. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.

H. Provide clearance for installation of insulation and access to valves.

I. Provide access where valves are not exposed.

3.2 VALVE TAGS

A. Furnish valves with 1-1/2 inch diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 2 inch letters.

Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3 feet of the equipment being served and the service is obvious.

B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve chart in the Operating and Maintenance Manuals.

3.3 PIPE SYSTEMS STRAINERS

A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION 22 05 23

SECTION 22 05 33 **PIPE HEAT TRACING**

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.

B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

A. Submit shop drawings and product data as specified in Section 22 05 12.

B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.

C. Submit manufacturer's certified capacity charts with selections plotted thereon.

D. Submit manufacturer's installation instructions.

E. Submit full load ampere requirement and voltage for branch circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Raychem Corporation

B. Thermon Manufacturing Company

2.2 COMPONENTS

A. Self-regulating heater.
1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.
6. Power connection, end seal, splice and tee kits components shall be applied in the field.

7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
8. Provide an end-of-circuit voltage indicating light

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.

B. Install the pipe heat tracing cable under the pipe insulation.

C. Apply “Electrically Traced” signs to the outside of the thermal insulation.

D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.

E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.

F. Use only electrical components as recommended by the manufacturer.

3.2 ELECTRICAL WORK

A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.

B. The specified wiring work includes:
1. Wiring of control instruments between thermostat and junction boxes
2. Installation of thermostat and junction boxes
3. Wiring from the heat tracing cable to the junction boxes

C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.

D. Provide devices and appurtenances as specified in Division 26.

E. Identify each circuit at each terminal with a separate tag.

F. Color code wires in accordance with IPCEA Standards.

G. Make all joints and connections with approved mechanical connectors.

3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

A. Test the pipe heat tracing system:
1. Simulate freezing outside air conditions
2. Measure the amperage draw of the heat tracing system
3. Compare to the manufacturer's capacity rating of the actual system

4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.

B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END SECTION 22 05 33

SECTION 22 07 19 PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.

C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated piping system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe insulation:
1. Johns-Manville Micro-Lok AP-T
2. Owens-Corning ASJ/SSL
3. Knauf ASJ/SSL

B. Cellular Glass Insulation (Foamglass):
1. Pittsburg Corning
2. Cell-U-Foam

C. Aluminum Jacketing:
1. Childers
2. Pabco
3. RPR

D. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh
2. Alpha Glass Mesh
3. Childers Chil-Glas
4. Vimasco

E. Mastics and Adhesives
1. Childers
2. Foster
3. Vimasco
4. Armstrong 520 Adhesive

F. Elastomeric Insulation
1. Armacell

G. Weather Resistant Coating
1. WB Armaflex Finish

H. Glass fiber blanket insulation
1. Manville R-series Microlite FSKL
2. Owens-Corning eD75 or ED100 RKF
3. Knauf 0.75 PCF FSK

2.2 FIBERGLASS PIPE INSULATION

A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.3 ELASTOMERIC INSULATION

A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum ¾" thick.

1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.4 CELLULAR GLASS INSULATION

A. ASTM C552:
1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
2. 8.0 lb./cu.ft. (128 kg/cu.m.) density

2.5 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
2. Minimum thickness of foam glass insulation shall not be less than 1" thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.6 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 adhesive.

B. Vapor Barrier Finish:
1. Indoors: Provide as insulation coating Childers CP-35, white.
2. Outdoors: Provide as insulation coating Childers Encacel X.
3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.

C. Sealant. Provide Childers CP-76 vapor barrier sealant.

D. Lagging Adhesive. Provide Childers CP-50.

E. Other products of equal quality will be acceptable only upon approval.

2.7 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.

B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.

C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.8 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.

B. Install hanger with protective shield, on the outside of all insulation.

C. Where domestic water pipes (1/2" & ¾" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.

D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.

E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.

F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.

G. Piping to be insulated as specified above:
1. All hot water.
2. Make-up water
3. All cold water subject freezing, main water entry to 50 linear feet within building and within exterior walls to five linear feet into plenum away from exterior wall.
4. Horizontal sanitary drain piping that receives condensate
5. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all horizontal rain leaders to first elbow turning down
6. Insulate entire wall hydrate box, valve and piping in exterior walls.

3.2 PIPING OUTDOORS ABOVE GRADE

A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.

B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.

C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.

D. Apply a tack coat of fitting mastic over the insulation and tape.

E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.

F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.

G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

H. Finish with aluminum jacketing as specified.

3.3 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
3. Overlap mastic and fiberglass cloth by 2” on adjoining sections of pipe insulation.
4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
5. Apply mastic to a wet film thickness of 3/64”.
6. Fabric shall not be visible after completion.
7. Vapor seal flanges, valves and fittings with Childers CP-35.

B. PVC fitting covers are not acceptable.

3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3” to make a weather tight seal.

C. Install straps on 9” centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 CONCEALED STORM DRAIN PIPING

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.

B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2” with facing to the outside to obtain specified R-value using a maximum of 25% compression.

C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3” wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3” (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6” (152mm) on center.

D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.6 MISCELLANEOUS

A. Install materials after piping has been tested and approved.

B. Apply insulation on clean, dry surfaces only.

C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.7 INSULATION THICKNESS

INSULATED UNIT	THICKNESS (Inches)
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2” Pipe and Smaller	1
Domestic Hot Water Piping, 2” Pipe and Larger	1-1/2

END OF SECTION 22 07 19

SECTION 22 08 00 PLUMBING COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section outlines commissioning requirements and activities of Contractor, Owner, CxA and Design Professionals as related to the Division 22 Plumbing.

B. Related Sections:
1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
2. Division 22 – Plumbing
3. Division 23 – Mechanical
4. Division 26 – Electrical

1.2 DEFINITIONS

A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTACT INFORMATION

A. The Owner will contract directly for commissioning services.
1. Commissioning Agent fee will be paid for directly by the owner.
2. Cost of contractor coordination with the CxA is specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment required for Functional Performance Testing is listed below. Data logging equipment and software required to test equipment shall be provided by the Contractor.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 1.0ºF and a resolution of + or - 0.2ºF). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT:

A. Ladders and/or lifts and appropriate fall protection as required by Contractor site requirements.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

A. Except for the activities to be performed by the CxA called for herein, all component and system installation work required by the Division 22, 23 and 26 specifications including specific contractor

furnished items indicated by this Section shall be provided by the Contractor.

3.2 SUBMITTALS

A. Plumbing
1. Plumbing Equipment.

3.3 EQUIPMENT START-UP

A. Notification
1. Contractor shall provide ten Owner business days' notice to CxA, Owner and Design Team of start-up dates.

B. Prior to start-up, contractor shall:
1. Verify that equipment and systems are complete, accessible, correctly connected to utilities and ready for operation. Perform all pre-start inspections and tests as called for in Division 22.
2. Comply with pre-start requirements of manufacturer and complete applicable documentation.
3. Complete applicable sections of Pre-functional Checklists.
4. Coordinate start-up attendance by manufacturer or authorized representative as required by specifications or manufacturer.

C. At start-up, contractor shall:
1. Supervise the activities of the authorized start-up technician or manufacturer's representative.
2. Verify proper voltage, phase, drive rotation and any other conditions that may cause damage if not correct.
3. Execute start-up under supervision of qualified contractor and equipment manufacturer personnel and in accordance with the manufacturer's instruction.
4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
5. Complete PFC's and provide documentation to CxA.
6. Provide documentation of any issues noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action.

3.4 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall forward completed copies of PFC's to the CxA for inclusion into the Cx documentation. PFC's will be provided by the CxA. As an alternate, contractor shall submit their versions of the PFC's to the CxA for review and comment.

B. Contractor shall complete PFC for each of the following equipment:
1. Plumbing:
a. Domestic Hot Water Heater/Converter
b. Recirculation Pump
c. Mixing Valve

3.5 FUNCTIONAL TESTING

A. General
1. Contractor shall organize and schedule Construction Team members to execute the functional testing, which will be directed by CxA.

B. Recirculation Pump
   1. Graphics
   2. Start/Stop/Schedule
   3. Pump Operation (On/Off/Hand/Auto)
   4. Temperature Sensor Calibration

C. Domestic Water Heater
   1. Graphics
   2. Start/Stop Schedule
   3. Discharge Temperature

END OF SECTION 22 08 00

SECTION 22 11 16 DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

A. Division 22 Plumbing
1. Valves, Strainers and Vents
2. Pipe and Pipe Fittings - General
3. Plumbing Piping Insulation
4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

A. Below Slab on Grade Piping for Water Entries:
1. 2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
2. 2-1/2-inch and 3-inch, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube, 20 ft. straight lengths. One joint allowed below slab entry using wrought copper, solder-joint pressure fittings: ASME B16.22 with an approved brazing filler metal or pipe can be shop bent for no joint installation by using a “bending” temper tubing.
3. 4-inch and larger, provide ductile iron pipe with mechanical joints, ANSI A21.6.
4. 3 inch and larger, provide one-piece stainless steel IBR (in building riser), Watts or Ames.

B. Below Grade Piping Outside Building (beyond 5’-0” of building): Provide PVC water main pipe 4 inch through 12 inch in diameter in conformance with AWWA C900. When using 3” or smaller provide Schedule 40 PVC ASTM D1785 with ASTM D-2466 socket type fittings. Provide fittings in conformance with ASTM 2466. Furnish pipe with a minimum pressure rating of 150 lbs. per square inch. Provide PVC pipe as manufactured by Johns-Manville, CertainTeed, Clow or approved equal.

C. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.

D. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.

E. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.

F. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.51. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.2 WATER HAMMER ARRESTORS

A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.

B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.

C. All water hammer arrestors shall be installed in a vertical position.

D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

PART 3 - EXECUTION

3.1 DRAINAGE

A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

3.2 STERILIZATION

A. Prior to starting work, verify system is complete, flushed and clean.

B. Inject chorine disinfectant in liquid, powder, tablet or gas form throughout the system to obtain 50 to 80 Mg/L residual.

C. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 20% of the outlets.

D. Retain disinfectant in system for 8 hours (minimum), 24 hours (maximum). During the disinfection process, operate all valves and accessories.

E. If final disinfectant residual tests less than 25 Mg/L, repeat treatment.

F. Flush disinfectant from system until chemical and bacteriological tests prove water quality equal to that of the service main.

G. Take samples no sooner than 24 hours after flushing from at least 10% of the outlets and from the water entry.
   1. Obtain a minimum of one water sample flushing from at least 10% of the outlets and from the water entry.
   2. Take samples from faucets located at highest point in the building, and farthest point from the main water supply.

H. After final flushing, remove aerators, clean and replace.

I. Chemical and bacteriological tests shall be conducted by a state certified laboratory.

J. The firm performing the disinfection shall have chemical laboratory experience.

K. Provide a laboratory report to indicate the following information.
1. Name and address of the approved laboratory testing the samples.
2. Name and location of the project and date the samples were obtained.
3. Mg/L chlorine during retention.
4. Mg/L chlorine after flushing.
5. The coliform organism count. (An acceptable test shall show absence of coliform organisms.)

L. If analysis does not satisfy the specified minimum requirements, repeat the disinfection procedure.

M. Submit for approval to the Architect/Engineer a copy of the laboratory report and the certification of performance. An approved copy of each document shall be inserted in the Owner's manual.

3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

3.4 TESTING

A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.

C. Use only potable water for the test.

D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.

E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.

F. Do not insulate or conceal piping systems until tests are satisfactorily complete.

G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.5 COPPER PIPE CORROSION PROTECTION

A. Corrosion protect copper tube piping systems:
1. In the building slab.
2. Beneath the building slab.
3. Buried.
4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.

B. Cover copper tubing piping system with:
1. "Tapecoat" TC Primer.
2. "Tapecoat" CT cold applied coating tape.

C. Install coating system as specified by the manufacturer.

D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM

A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).

B. Make repairs to small holes in accordance with the manufacturer's instructions.

C. Retest the repairs using procedures listed above.

D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION 22 11 16

SECTION 22 11 19 PIPING AND PIPING APPURTENANCES FOR COLD WATER MAKEUP

PART 1 - WORK INCLUDED

1.1 SCOPE

A. Furnish and install piping and piping appurtenances for cold water makeup piping.

1.2 RELATED WORK

A. Division 22 Plumbing
1. Valves, Strainers and Vents
2. Plumbing Pipe and Pipe Fittings
3. Plumbing Piping Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Provide seamless, hard-drawn, Type L, copper water tube conforming to ASTM B88, and wrought copper fittings.

2.2 BACKFLOW PREVENTER

A. Watts Series 909 reduced pressure principal backflow preventer.

B. Factory assembled components as follows:
1. Isolating, shutoff, full port ball valves.
2. Incoming bronze strainer.
3. Test cocks.
4. Fixed air gap assembly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install according to manufacturer's instructions.

3.2 BACKFLOW PREVENTERS

A. Provide backflow preventers at the following locations.
1. HVAC Systems cold water make-up including chilled water, hot water and condenser water.
2. Pumping systems including water utility service and water softening equipment.
3. Where required by Code.

B. Installation according to manufacturer's recommendations.
1. Connect drain with fixed air gap assembly.
a. Pipe full size discharge from relief valve of RPZ to nearest floor drain or floor sink of proper size. Reference manufacturer’s suggested sizing of drains.
2. Provide pipe unions on inlet, outlet and discharge connection of the assembly for complete removal.
3. Provide isolation valve upstream of backflow assembly to allow complete removal of listed assembly.

4. Install backflow preventer assembly horizontally in an accessible location for testing and maintenance at a height not to exceed 60" above finished floor and no lower than 12" from finished floor to air gap outlet.

C. Provide certified testing of all backflow preventers.
1. Include certificates in O&M Manuals.

END OF SECTION 22 11 19

SECTION 22 11 23 DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General characteristics for pumps specified in Division 22 - Plumbing.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 22 - Plumbing, including the following:

A. Division 22 Plumbing - Electrical Provisions of Plumbing Work.

1.3 PUMP SELECTION

A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.

B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.

C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.

D. The pump curve shall rise continuously from maximum flow to cut-off.

E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.

F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.

G. Select the pump for operation at or near peak efficiency.

H. Cavitation-free at all points on the curve.

I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

1.4 PUMP SIZE AND TYPE

A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.

B. Submit copies of manufacturer’s performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 DOMESTIC HOT WATER CIRCULATING PUMPS (SMALL) FRACTIONAL HORSEPOWER

A. Pump Construction:
1. Wet-rotor, in-line, single stage
2. Bronze housings with ½" and ¾" sweat connections
3. Stainless steel housing with union threaded connections
4. Integrated check valve inside union fitting on a sweat pump housing
5. Built-in 5-foot, 115 volt AC line cord with NEMA 3 Prong male plug or line cord
6. Built-in timer
7. Aquastat thermostatic control

B. Acceptable manufacturers:
1. Bell & Gossett
2. Armstrong
3. Aurora
4. Grundfos

2.2 SUBMERSIBLE SUMP PUMPS AND SEWAGE EJECTORS

A. Pump Construction:
1. Hermetically sealed motor
2. Positive action air operated diaphragm switch
   a. High water alarm contact
3. Housing and base cast iron construction

B. Provide an alarm terminal cabinet.
1. In the event of a high water alarm, energize a pulsing 2" diameter red signal light with graphic "sump pump high water alarm".

C. Test the sump pump package by operation of the completed system through four cycles of operation.
1. Fill the sump to operational levels
2. Visually check level controls
3. Pump operation
4. Verify absence of piping leaks, sump leaks, excessive noise, and excessive vibration
5. Verify alarms
6. Verify pump capacity

D. Sump pump package capacity shall be as scheduled.

E. Acceptable Manufacturers:
1. Hydromatic
2. Little Giant Pump Co.
3. Weil
4. Goulds
5. Grundfos

6. Crane (Barnes) Air Pumps
7. Ebara
8. Zoeller Pumps

2.3 FLOW INDICATOR

A. Flow Indicator
1. Bronze Construction
2. Rotating wheel
3. Line Size
4. Double Window
5. Ernst Flow Industries Model EFI E-57-3

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
1. Provide access space around pumps for service.
2. Lubricate pumps prior to start-up.
3. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60” above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.

B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge.

C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.

D. Ensure pumps:
1. Operate at specified system fluid temperatures without vapor binding and cavitation.
2. Are non-overloading in parallel and individual operation.
3. Operate within 25 percent of midpoint of published maximum efficiency curve.

E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 MANUFACTURER START-UP SERVICE ALIGNMENT

A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
1. Technicians, as required, shall be trained and experienced in the work they perform (Contractor start-up / alignment is unacceptable).

B. Before starting pumps, but after connecting piping:
1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
2. Tabulate the actual pump alignment reading with manufacturer's minimum

tolerances.

3. Submit readings for approval.
4. Include the approved readings in the Owner's Maintenance Manual.

3.4 FINAL PUMP FLOW CALIBRATION

A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
   1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
   2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.

B. Enter the information on the final configuration of the pump in the Owner's Manual.
   1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.5 SPARE PARTS

A. Provide the following spare parts and material to the Owner for his use after the warranty period.
   1. A mechanical seal for each pump
   2. A set of bearings for each pump

END OF SECTION 22 11 23

SECTION 22 11 25 DOMESTIC WATER BOOSTER PUMP

PART 1 – GENERAL

1.1 WORK INCLUDED

A. Variable Speed Packaged Pumping System with VFDs.

1.2 REFERENCE STANDARDS

A. The work in this section is subject to the requirements of applicable portions of the following standards:
1. ANSI – American National Standards institute
2. ASTM – American Society for Testing and Materials
3. IEEE – Institute of Electrical and Electronics Engineers
4. NEMA – National Electrical Manufacturers Association
5. NEC – National Electrical Code
6. ISO – International Standards Organization
7. UL – Underwriters Laboratories

1.3 SUBMITTALS

A. Submit shop drawing and product as specified.

B. Submit manufacturer's certified capacity data.

C. Submit manufacturer's installation, start-up and service instructions.
1. Electrical Interlocks

D. Submit wiring diagram.

1.4 SHIPPING, HANDLING AND STORAGE

A. Deliver, store, protect, and handle in accordance with recommended practices listed in manufacturer's Installation and Maintenance Manuals. All equipment and accessories shall be suitably boxed, crated, covered and protected internally and externally to prevent shipping damage and damage from the weather.

B. Inspect and report concealed damage to carrier within specified time.

C. Store in a clean, dry space. Maintain factory protection or cover to keep out dirt, water, construction debris, and traffic (heat enclosures to prevent condensation).

PART 2 – PRODUCTS

2.1 VARIABLE SPEED PACKAGED PUMPING SYSTEM WITH INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

A. Furnish and install a prefabricated and tested variable speed packaged pumping system to maintain constant water delivery pressure.

B. The packaged pump system shall be a standard product of a single pump manufacturer. The entire pump system including pumps and pump logic controller shall be designed and built by the same manufacturer.

C. The complete packaged water booster pump system shall be certified and listed by UL (Category QCZJ – Packaged Pumping Systems) for conformance to U.S. and Canadian Standards.

2.2 PUMPS

A. All pumps shall be ANSI/NSF 61 approved for drinking water.

B. The pumps shall be of the in-line vertical multi-stage design.

C. The head capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.

D. Small vertical in-line multi-stage pumps (nominal flow from 3 to 125 gallons per minute) shall have the following features:

1. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement.
2. The suction / discharge base shall have ANSI Class 250 flange or internal pipe thread (NPT) connections as determined by the pump station manufacturer.
3. Pump Construction:

Suction/discharge base, pump head, motor stool	Cast Iron (Class 30)
Impellers, diffuser chambers, outer sleeve	304 Stainless Steel
Shaft	316 or 431 Stainless Steel
Impeller wear rings	304 Stainless Steel
Shaft journals and chamber bearings	Silicon Carbide
O-rings	EPDM
Shaft couplings for motor flange sizes 184TC and smaller shall be made of cast iron or sintered steel. Shaft couplings for motor flange sizes larger than 184TC shall be made of ductile iron (ASTM 60-40-18)	
Optional materials for the suction/discharge base and pump head shall be cast 316 stainless steel (ASTM CF-8M resulting in all wetted parts of stainless steel.	

4. The shaft seal shall be a balanced o-ring cartridge type with the following features:

Collar, Drivers, Spring	316 Stainless steel
Shaft Sleeve, Gland Plate	316 Stainless Steel
Stationary Ring	Silicon Carbide
Rotating Ring	Silicon Carbide
O-Rings	EPDM
The Silicon Carbide shall be imbedded with graphite.	

5. Shaft seal replacement shall be possible without removal of any pump components other than the coupling guard, shaft coupling and motor. The entire cartridge shaft seal shall be removable as a one-piece component. Pumps with motors equal to or larger than 15 HP (fifteen horsepower) shall have adequate space within the motor stool so that shaft seal replacement is possible without motor removal.

2.3 INTEGRATED VARIABLE FREQUENCY DRIVE MOTORS

A. Each motor shall be of the integrated Variable Frequency Drive design consisting of a motor and a variable frequency drive (VFD) built and tested as one unit by the same manufacturer.

B. The VFD shall be of the PWM (Pulse Width Modulation) design using current IGBT (Insulated Gate Bipolar Transistor) technology.

C. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump control and to eliminate the need for motor de-rating.

D. The VFD shall utilize an energy optimization algorithm to minimize energy consumption. The output voltage

E. The VFD shall automatically reduce the switching frequency and/or the output voltage and frequency to the motor during period of sustained ambient temperatures that are higher than the normal operating range. The switching frequency shall be reduced before motor speed is reduced.

F. An integral RFI filter shall be standard in the VFD.

G. The VFD shall have a minimum of two skip frequency bands which can be field adjustable.

H. The VFD shall have internal solid-state overload protection designed to trip within the range of 125% - 150% of rated current.

I. The integrated VFD motor shall include protection against input transients, phase imbalance, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over-temperature. Three-phase integrated VFD motors shall be capable of providing full output voltage and frequency with a voltage imbalance of up to 10%.

J. The integrated VFD motor shall have, as a minimum, the following input/output capabilities:
1. Speed Reference Signal: 0-10 VDC, 4-20mA
2. Digital remote on/off
3. Fault Signal Relay (NC or NO)
4. Fieldbus communication port (RS485)

K. The motor shall be Totally Enclosed Fan Cooled (TEFC) with a standard NEMA C-Face, Class F insulation with a temperature rise no higher than Class B.

L. The cooling design of the motor and VFD shall be such that a Class B motor temperature rise is not exceeded at full rated load and speed at a minimum switching frequency of 9.0 kHz.

M. Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,00 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

2.4 PUMP SYSTEM PROGRAMMING

A. Pump system programming (field adjustable) shall include as a minimum the following:
1. Water shortage protection (analog or digital)
2. Transducer Settings (Suction and Discharge Analog supply/range)
3. PI Controller (Proportional gain and integral time) settings.
4. High System pressure indication and shut-down
5. Low system pressure indication and shut-down
6. Low suction pressure/level shutdown (via digital contact)
7. Low suction pressure/level warning (via analog signal)
8. Low suction pressure/level shutdown (via analog signal)
9. Flow meter settings (if used, analog signal)

PART 3 - EXECUTION

3.1 FACTORY FABRICATION

A. All of the above equipment will be mounted on an open structural steel I-beam skid. All piping, pressure sensing lines, pump by-pass, shut-off valves, stuffing box and casing relief valve drains will be firmly anchored to the steel base by means of structural steel supports. All electrical wiring between controllers and drivers will be completed and tested at the factory. The entire package will require one power connection by the electrical contractor.

3.2 INSTALLATION

A. Installation shall be in accordance with manufacturer's instructions.

3.3 FIELD ACCEPTANCE AND START-UP SERVICE

A. The service of a factory-trained representative shall be made available on the job site to check installation, field acceptance testing, start-up and instruct operating personnel.

B. In order to ensure the pump unit is properly coordinated and will function in accordance with the intent of these specifications, all the equipment required to comprise the pump unit will be supplied by the pump manufacturer in whom shall be vested unit responsibility for the proper function of the complete pump unit including the pump, motor or engine, base plate, control equipment and other required accessories.

C. To verify compliance with this requirement, the pump manufacturer will be required to submit a notarized Certificate of Compliance certifying that all components of the pump unit were in fact supplied by the pump manufacturer and acknowledging its responsibility for the proper function of the unit.

3.4 GUARANTEE

A. The pumping system shall be guaranteed in writing, by the manufacturer for a period of one year from date of shipment against defect in design, material or construction.

END OF SECTION 22 11 25

SECTION 22 13 16 **SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES**

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

A. Site Work:
1. Sanitary Sewers
2. Excavation, Trenching and Backfilling for Utilities

B. Division 22 Plumbing:
1. Pipe and Pipe Fittings
2. Plumbing Fixtures and Fixture Carriers
3. Drains, Cleanouts and Hydrants
4. Earthwork

1.3 REFERENCES

A. CISPI - Cast Iron Soil Pipe Institute

B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. All No-Hub clamps must have 4 bands minimum. Sizes 5” through 10” shall have six bands minimum.
1. No-Hub Clamps – Sanitary Waste:
a. Husky SD 4000
2. No-Hub Clamps - Vents
a. Husky SD – 2000
b. Mission Rubber Co., LLC Heavy Weight Couplings
3. Clamp-All Hi-TorQ 80 or approved equal

B. Provide Husky shielded couplings Series SD 4200 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2” through 8” Series SD 4200.

C. Cast Iron Soil Pipe and Fittings:
1. AB&I
2. Charlotte Pipe and Foundry Co.
3. Tyler Pipe / Soil Division

2.2 DRAIN PIPE AND FITTINGS

A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
2. Pipe shall conform to ASTM A74.

3. No-hub couplings shall meet or exceed the latest specification standard CISPI 310 or ASTM C-1540 and conform to FM 1640. CISPI 310 Couplings shall be listed by NSF International.
4. Rubber Gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
5. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute

B. Below Slab on Grade Piping:
1. Schedule 40 PVC plastic pipe and DWV fittings.
2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.

C. Below Slab on Grade Piping for Grease Waste as indicated on Drawings
1. Schedule 40 CPVC pipe and fittings
2. Solvent welded DWV joints shall conform to ASTM D3311 and be produced to dimensions specified in ASTM F 2618, NSF International, UPC, IAPMO IGS 210 and International Plumbing Code.
3. Solvent Cement, Heavy Body; mustard yellow color, as tested by ASTM F 2618 / ASTM F493
4. Manufacturer: Spears (only)

2.3 VENT PIPE AND FITTINGS

A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
2. Pipe shall conform to ASTM A74.
3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF International
4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564

B. Below Slab on Grade Piping:
1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.

C. Above Slab Pipe.
1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations and equipment discharge piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with Cast Iron Soil Pipe Institute Standards.

B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers are to be placed within 18” of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15’-0”.

C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer’s recommendations and applicable standards.

D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed outside the building slab.

E. All PVC underground shall be installed in accordance with ASTM D2321.

3.2 GRADE

A. Give horizontal pipe grade of ¼-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

3.3 DRAIN PIPE AND FITTINGS

A. Offsets and Fittings.
1. Use reduction fittings to connect two pipes of different diameter.
2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eights-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
4. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8th bend fittings are not allowed for horizontal to horizontal piping systems per Code.

B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.

C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
2. Provide cleanouts where soil lines change direction, every 50 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.

D. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.

3.4 VENT PIPING

A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.

B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.

C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.

3.5 TESTING

A. Below Slab on Grade and All Floors in Multi-Story Buildings:
1. Test pipe below slab on grade before backfilling and connecting to city sewers.
2. Maintain not less than 10 foot of hydrostatic head for1 hour without a leak.
3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.

B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
1. Plugging outlets.
2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
3. Test for 6 hours without any drop in the water level.

3.6 RODDING SEWERS

A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed prior to substantial completion. All floor drains and cleanout locations must be included in this work.

B. All sanitary soil and waste lines below building 3” and larger shall be internally videotaped at time of substantial completion. All videotaping shall include on-screen date and time, and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. An Owner’s Representative shall be present during video-taping. Three copies of the videotape shall be delivered to the Owner for future records.

C. This work shall be done in the presence of the Owner’s Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

3.7 SMOKE TESTING

A. Interior Plumbing Piping:
1. Contractor shall perform smoke testing on all interior sanitary sewer piping and sanitary vent piping above and below floor prior to cover-up..
2. Artificially created smoke used must be a persistent white tracer smoke and produced by

Superior Signal Smoke Candles.

3. All plumbing fixtures must be installed including floor drains with wetted trap seals.
4. Smoke testing shall be performed after completion of any videotaping, rodding or flushing of the sanitary system. Test must be performed prior to ceiling installation in new construction projects. Smoke is usually injected into the building through the two-way cleanout in the main sewer line leaving the building or a plumbing roof vent or fixture. Smoke will travel through the sanitary sewer and vent system and through the air spaces in the sewer lines and emanate from any leaks in the system. The smoke must reach the last roof vent in the system to indicate the entire system has been completely filled with smoke. The smoke must travel the full length of the piping system. Contractor must provide manpower as necessary to visually trace the flow of smoke through the wall cavities, annular floor/ceiling spaces, inject the smoke, observe the roof vents and to identify the integrity problems.
5. Contractor shall provide a detailed list of findings and a drawing indicating the location, fixture type, type and size of pipe, and or description of type of problems found.
6. Typical findings from indoor smoke testing may include:
   a. Dry traps in floor drains
   b. Improperly capped sewer lines or vents
   c. Broken sewer lines or vents
   d. Cross connected sewer vents and drains
   e. The drawing of air emanating from sewer vents into intakes of air exchange systems
   f. Poorly glued pipe joints
   g. Loose no-hub couplings
7. An Owner's Representative shall be present during smoke testing.

END OF SECTION 22 13 16

SECTION 22 20 00 PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

A. Division 22 Plumbing
1. Earthwork
2. Valves, Strainers and Vents
3. Insulation
4. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

C. Solder joints.
1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.

4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
2. 6" through 10" pipe size coupling housing minimum of 4" width.
3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.

G. Compression Gasket System. Bell and spigot cast iron pipe 4" and smaller, use flax-base lubricant, Tyler Ty-Seal Lubricant or Charlotte Regular Lubricant. 6" and larger use a neoprene base lubricant, Charlotte Adhesive Lubricant.

H. Press fittings for copper pipe 1/2” to 4”: Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing

through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.

D. Install piping without tapping out of the bottom of pipe.

E. Press Connections: Copper and steel press fittings ½” through 4” shall be applied in accordance with the manufacturer’s installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-“Pro-Press”.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.

B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.

F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.

B. Provide supports both sides of elbows for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.

D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.

E. Install trapeze hangers, properly sized, to support the intended load without distortion.

F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.

G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.

H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the

manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.

C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until “potable water clear” and particles larger than 5 microns are removed.

D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.

E. Dispose of water in approved manner.

F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.

G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.

H. Submit status reports upon completion of each phase of work on each system.

3.13 TESTING

A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Do not insulate or conceal piping systems until tests are satisfactorily complete.

C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
1. Both sides of penetrations through walls, floors and ceilings.
2. Close to valves or flanges.
3. Intervals on straight pipe runs not to exceed 50 feet
4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION 22 20 00

SECTION 22 33 33 ELECTRIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electric water heaters for domestic water systems.

1.2 RELATED WORK

A. Division 22 Plumbing
   1. Domestic Water Piping.
   2. Plumbing Piping Insulation.
   3. Division 26 Electrical.

1.3 WARRANTY

A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lochinvar.

B. Bradford White with Microban

C. Rheem

D. A. O. Smith

2.2 PRODUCTS

A. Provide electric water heaters with kilowatt, recovery ratings, and storage capacities as scheduled on drawings.

B. Provide an ASME code construction tank designed for 150 psig working pressure. Furnish glass-lined tank. Lining shall be corrosion-resistant.

C. Furnish factory-assembled, integral units equipped as follows:
   1. Immersion thermostat.
   2. High temperature limit switch (energy cutout).
   3. Low-water cutoff.
   4. Heavy duty UL rated for 100,000 cycles.
   5. Temperature and pressure relief valve.
   6. Anode rod.

D. Provide heavy-duty, medium watt density elements having nicoloy sheathing and prewired leads.

E. The entire vessel shall be enclosed in a round steel enclosure with baked enamel finish and shall enclose the tank with R-16 foam insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

B. All installations shall be in accordance with the manufacturer's published recommendations.

C. Furnish all supports required by the equipment included in this Contract.

D. Provide a 4" thick reinforced concrete housekeeping pad beneath heaters.

E. Furnish and install all necessary valves, traps, gauges, strainers, unions, etc. to facilitate proper functioning and servicing of equipment.
   1. Install a line size shutoff valve in cold water inlet and hot water outlet close to each heater.
   2. Provide a temperature gauge in the domestic hot water piping within five feet of outlet to each heater, upstream of all shut-off valves. Size and locate gauges to be easily readable from a standing position.

F. Provide dielectric isolation device where copper lines connect to ferrous lines or equipment, such as dielectric coupling or dielectric flange fitting.

G. Route condensate to a vented receiver.

H. Pipe relief valve discharge and all equipment drains indirectly to appropriate floor drain.

I. Set the operating and safety controls.

J. Set thermostats on domestic water heaters to delivery maximum water temperature as indicated on Contract Drawings.

K. Furnish and install an expansion tank on cold water supply to heater. Locate tank as close to water heater as possible between water heater and all check valves or backflow preventers. Expansion tank capacity shall be as scheduled on Contract Drawings. Install expansion tank in accordance with manufacturer's recommendations.

L. Install water heater in galvanized drain pan piped to floor drain. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.

3.2 STARTUP

A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

END OF SECTION 22 33 33

SECTION 22 34 32 GAS-FIRED DOMESTIC WATER HEATER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Gas-fired domestic hot water heating systems, including hot water heaters, storage tanks, control valves, and pressure and temperature relief valves, as required.

1.2 RELATED ITEMS

A. Division 22 Plumbing:
1. Domestic Water Piping
2. Gas Piping
3. Flue Piping
4. Plumbing Piping Insulation

1.3 CERTIFICATION

A. Provide water heater listed by UL Laboratories, according to ANSZ21.10 Standards governing storage-type water heaters. Must meet ASHRAE/IESNA 90.1-1999 and be design-certified by Underwriter's Laboratories for 180°F water. Must meet SCAQMD Rule 1146.2 for low-nox emissions.

1.4 WARRANTY

A. Provide standard manufacturer's 1 year commercial warranty for mechanical and electrical and 5 year warranty for leaks. Warranty shall start the date of the substantial completion certificate.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. A.O. Smith

B. Lochinvar

C. Bradford White

2.2 CAPACITY

A. Water heaters shall have the storage capacity and gallons per hour recovery at 100°F rise as scheduled.

2.3 TANK

A. Construct the tank with a 125 psi ASME rating in accordance with the ASME Code, Section IV. Tank shall have a seamless glass-lined steel tank construction.

B. Powered Anodes.

2.4 BURNER

A. A spiral-shaped heat exchanger placed entirely inside the tank which shall be glass-lined on the flue gas side to protect against acidic flue gas condensate.

B. Heater shall have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up.

2.5 INSULATION

A. Insulate the water heater with factory applied foam insulation and trim with a heavy-gauge, enameled steel jacket.

2.6 CONTROLS

A. Furnish 120V controls for heaters of 100,000 BTUH and above. Controls shall be an integrated solid-state temperature and ignition control device with integral diagnostics, LED fault display capability, and a digital display of temperature system.

2.7 FLUE

A. This water heater(s) shall be suitable for sealed combustion direct-venting with 4" diameter PVC air intake pipe and 4" diameter PVC exhaust pipe for a total of 70 feet of intake and 70 feet of exhaust. Provide a properly sized thermal expansion tank as scheduled on drawings. Refer to manufacturer's installation instructions for material types used in air intake and exhaust pipe use.

2.8 CARBON MONOXIDE MONITORING SYSTEM

A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room when combustion air is ducted to boilers. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide detector shall disable the boiler's burner upon loss of power to the detector.

B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module.
1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
2. NEMA 1 Enclosure
3. Complies with Texas State Boiler Code 65.603-2015
4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
5. Provide expansion board for additional equipment interlocks.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install a line size valve in the cold water supply close to each heater and a line size plug cock in the gas supply close to each heater.

B. Provide approved dielectric couplings at all cold water and hot water connections to storage tank, and at pressure and temperature relief valve connection.

C. Install according to manufacturer's specifications and pipe as shown.

D. Install water heater in galvanized drain pan piped to floor drain. Provide ¾" outlet connection. Elevate water heater tank bottom above drain pan as to not allow standing water inside of drain pan to touch bottom of tank.

E. Provide and install acid neutralization box for each heater on condensate from exhaust vent.

3.2 STARTUP

A. Startup shall be performed by factory trained and authorized personnel. The factory representative shall also provide a technical and practical operation and maintenance training seminar including a hands-on operation and maintenance demonstration, and classroom presentation with handouts and visual aids, for no less than three physical plant personnel.

B. Startup procedure shall include a functional test of Carbon Monoxide Detector. Simulate an alarm condition and demonstrate the functionality of the detector shutting down the appliances. Owner / Engineer shall be present to witness test.

END OF SECTION 22 34 32

SECTION 22 40 00 PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

A. Division 22 Plumbing
1. Drains, Hydrants and Cleanouts.
2. Domestic Water Piping.
3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Porcelain to steel and enameled cast iron fixtures shall be acid resistant. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Plumbing Fixtures (Vitreous China):
1. American Standard.
2. Toto
3. Zurn

B. Plumbing Faucets:
1. American Standard.
2. Chicago.
3. T&S Brass.
4. Zurn.

C. Supports and Carriers:
1. Wade
2. Zurn
3. J.R. Smith.
4. Josam.
5. Watts
6. MIFAB

D. Flush Valves:
1. Sloan
2. Zurn

E. Supplies, Stops and Chrome Plated Tubular Brass:
1. McGuire

F. Water Closet Seats:
1. Beneke

2. Church
3. Olsonite
4. Bemis

G. Electric Drinking Fountains:
1. Halsey Taylor
2. Elkay
3. Oasis

H. Floor Drains:
1. Wade
2. J.R. Smith
3. Josam
4. Zurn
5. Watts
6. Sioux Chief
7. MIFAB

I. Cleanouts:
1. Wade
2. J.R. Smith
3. Josam
4. Zurn
5. Watts
6. MIFAB

J. Shower Valves
1. Chicago
2. Acorn
3. Symmons
4. Bradley

K. Stainless Steel Sinks:
1. Elkay
2. Just
3. Franke

L. Mop Sinks:
1. Crane Fiat
2. Stern Williams
3. Acorn
4. CECO

M. Service Sinks:
1. American Standard
2. Kohler
3. Eljer

N. Roof Drains:
1. Wade
2. J.R. Smith
3. Josam
4. Zurn
5. Watts
6. MIFAB

O. Thermostatic Mixing Valves
1. Lawler
2. Symmons
3. Powers
4. Bradley

P. Shock Arrestors:
1. Precision Products
2. Sioux Chief

Q. Backflow Preventors
1. Watts
2. Febco
3. Wilkins
4. Beeco

R. Hose Bibbs
1. Wade
2. Chicago
3. Josam
4. Woodford
5. Zurn
6. J.R. Smith
7. MIFAB

S. Wall Hydrants
1. Wade
2. Woodford
3. Zurn
4. J.R. Smith
5. Josam
6. MIFAB

T. Solids Interceptors
1. Wade
2. J.R. Smith
3. Zurn
4. Josam
5. MIFAB

2.2 REQUIREMENTS

A. Refer to the drawings for equipment to be supplied.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's instructions.

B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.

C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for

a complete installation.

D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.

E. Remove piping and services roughed-in incorrectly and install correctly, without cost.

F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.

G. Coordinate with the Contractor for locations and service required for each plumbing fixture.

H. All floor drains and floor sinks shall have trap primer connections. Provide trap primer valves and 1/2-inch water line to each floor drain connection. Trap primer supply line shall have ball valve and Y strainer on inlet side of trap primer valve to facilitate cleaning.

I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.

J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel vandal resistant screws.

K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION 22 40 00

SECTION 22 63 11 GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.

B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.

C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

A. Division 22 Plumbing
1. Plumbing Pipe and Fittings
2. Valves and Vents

1.3 UTILITY CONNECTIONS

A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

A. Pipe 2 inch and Smaller:
1. Schedule 40 ASTM A 53 black steel pipe
2. Factory fabricated socket weld fittings.

B. Pipe Larger than 2 inch:
1. Schedule 40 ASTM A 53 black steel pipe.
2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).

C. Unions:
1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
2. Ground joint unions, with bronze seat.
3. Flange joints for pipe larger than 2 inch in diameter.

D. Flanges:
1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.

B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe Industries, Inc. or Performance Pipe.

C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

2.3 VALVES

A. See Section 22 05 23.

2.4 GAS PRESSURE REGULATOR

A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.

B. All line pressure regulators shall be listed in accordance with ANSI (American National Standard) Z21.80 and CSA (Canadian Standards Association Standard) 6.22.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.

B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.

C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.

D. Sleeves.
1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.

E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.

F. Weld all gas piping above grade.

G. Provide test ports and isolation valves to enable proper testing of system in the future.

H. Provide isolation valve and unions across regulators for proper removal.

I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.

J. Gas Pressure Regulators / Vents:
1. Piping shall be sized in accordance with the regulator manufacturer’s instructions. Never use pipe sizes smaller than the vent size; smaller pipe sizes restrict the gas flow. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors. Headers with

various installed devices can cause regulator malfunction.

2. Support the vent pipe to eliminate strain on the regulator diaphragm case.
3. Install vent piping from regulators to location to prevent gas smells from entering building. Do not locate the vent line terminus near windows, fans, or other ventilation equipment. See the installation instructions furnished with the regulator.
4. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering. Always point outdoor vent pipes in the downward position to reduce the possibility of rain, snow, sleet, and other moisture entering the pipe.
5. When installed inside building route vents horizontally and terminate through building sidewall. The vent must be piped to the outside atmosphere using the shortest length of pipe, the fewest possible pipe elbows, and a pipe diameter as large as the vent size or larger. If a long gas run must be used, increase the pipe one nominal size every ten feet to keep the flow restriction as low as possible. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
6. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.
7. Ensure the end of the vent line is away from ANY potential ignition sources. It is the installer’s responsibility to ensure the vent line is exhausting to a safe environment
8. Adhere to all applicable codes and regulations.

3.2 TESTING GAS PIPING

A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not less than eight hours without noticeable drop.

B. Test joints with a soap solution while lines are under pressure.

C. Repair leaks.

D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure.

E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.

F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
   1. To find form online, go to: Texas School Gas Test Form

3.3 IDENTIFICATION CONDUCTOR

A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.

B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
   1. Bolted gasketed cover with stainless steel screws.
   2. Screw type terminal strip.
   3. Legend on cover "gas pipe identification conductor."

C. Set in concrete pad.

3.4 PAINT EXPOSED OUTSIDE GAS PIPE

A. Interior and Exterior Gas piping shall be protected from rust.

B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION 22 63 11

SECTION 23 01 00 HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
1. Table of Contents for each element.
2. Contractor information.
3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
4. All parts and maintenance manuals for items of equipment.
5. Warranties (without starting dates)
6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates).
9. Control operations/equipment wiring diagrams.
10. Schedule of filters for each item of equipment.
11. Schedule of belts for each item of equipment.
12. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit completed manuals in final electronic form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.

D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Electronic copies of complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black three-ring binders with clear overlay plastic covers.

B. Minimum ring size: 1".
Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11".
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable.
   c. Identity of general subject matter covered in the manual.
6. Binder as specified.

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number.
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer.
      2) Maintenance contractor as appropriate.
      3) Identify area of responsibility of each.
      4) Local source of supply for parts and replacement.
   d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product.
   b. Annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:
      1) Relations of component parts of equipment and systems.
      2) Control and flow diagrams.
   b. Coordinate drawings with information in Project Record Documents to assure

correct illustration of completed installation.

c. Do not use Project Record Documents as maintenance drawings.

4. Written text, as required to supplement product data for the particular installation:
   a. Organize in consistent format under separate headings for different procedures.
   b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued.
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure.
      2) Instances that might affect validity of warranties or bonds.
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems.

1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts.
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine and normal operating instructions.
      2) Regulation, control, stopping, shut down and emergency instructions.
      3) Summer and winter operating instructions.
      4) Special operating instructions.
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting.
      3) Disassembly, repair and reassembly.
      4) Alignment, adjusting and checking.
      5) Routine service based on operating hours.
   d. Servicing and lubrication schedule. List of lubricants required.
   e. Manufacturer's printed operating and maintenance instructions.
   f. Description of sequence of operation by control manufacturer.
   g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Predicted life of part subject to wear.
      2) Items recommended to be stocked as spare parts.
   h. As installed control diagrams by controls manufacturer.
   i. Complete equipment internal wiring diagrams.
   j. Schedule of filters for each air handling system.
   k. Schedule of belts for each item of equipment.
   l. Each Contractor's coordination drawings.
   m. As installed color coded piping diagrams.
   n. Charts of valve tag number, with location and function of each valve.
   o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
   p. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
4. Provide complete information for products specified in Division 23.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.
9. Provide extended compressor warranty certificates.

END OF SECTION 23 01 00

SECTION 23 05 00 MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.

B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Mechanical work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department
5. Texas Department of Licensing & Regulations (ADA)

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducibles is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and Revit CAD files on disk (CD Rom).

C. As-Built drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s seal, name, address and logo from drawings.
3. Mark documents RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY
5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
6. Indicate exact location of all underground mechanical piping and elevation.
7. Indicate exact location of all underground electrical raceways and elevations.
8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
10. Exact location of all electrical equipment in and outside of the building.
11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
12. Cloud all changes.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open

ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion

of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

3.3 LUBRICATION, REFRIGERANT AND OIL

A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.

B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.

C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.4 HOUSEKEEPING PADS

A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:
   1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings

2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

3.5 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
1. Provide the training during the Owner's regular working day.
2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.
3. All training shall be video recorded and provided in digital format to owner.

B. Time to be allocated for instructions.
1. Provide 6 hours of instructor training and 6 hours of onsite demonstration.
2. 8 hours on each of 5 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
1. One copy to the Owner.
2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.6 EQUIPMENT IDENTIFICATION

A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
   1. Designation approved by Architect/Engineer.
   2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
   3. Submit schedule of equipment to be included and designations.

B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.7 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.8 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

3.9 INDOOR AIR QUALITY

A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.

B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.

C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.

D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.

E. Utilize manufacturer’s recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.

F. Ventilate completed building prior to final completion using no less than design outside air for at least 48 hours before occupancy.

G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air

distribution system.

H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION 23 05 00

SECTION 23 05 10 HVAC CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
1. Field conditions.
2. Condition of installation.
3. Quality of workmanship.
4. Start-up of equipment.
5. Testing, adjusting, and balancing of equipment.

B. Representative shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK-UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock-up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
1. Rough-in.
2. Finish with all appurtenances in place.
3. Insulation installed.
4. Demonstrations.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 FAN/COIL UNITS

A. Mock-up a fan/coil unit completely installed, including:
1. Primary, secondary and auxiliary drain pans.
2. Piping connections; including all piping appurtenances.
3. Pipe insulation.
4. Condensate drain piping.
5. Electrical connections.
6. Duct connection beyond first transition.
7. Block valves, balancing valves, and control valves.
8. Cabinet/internal vibration isolation.
9. Suspension system.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
1. Filter accessibility.
2. Accessibility to drain and components for service.
3. Controls sequence.

3.2 AIR HANDLING UNIT

A. Mock-up an air handling unit, completely installed, including:
1. Piping connections; including thermowells, test stations, test wells and other piping appurtenances.
2. Pipe insulation.
3. Condensate drain piping.
4. Electrical connections.
5. Ductwork beyond the first transition.
6. Control valves and bypass.
7. Cabinet/internal vibration isolation.

8. Block valves and balancing valves.
9. Duct insulation.
10. Instrumentation.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
1. Filter accessibility.
2. Accessibility to drain and components for service.
3. Controls sequence.

3.3 VARIABLE AIR VOLUME TERMINAL BOX

A. Mock-up a Constant Volume Terminal Box completely installed, including:
1. Piping connections, including all piping appurtenances.
2. Pipe insulation.
3. Electrical connections.
4. Duct connection beyond first transition.
5. Block valves, balancing valves, and control valves.
6. Cabinet/internal vibration isolation.
7. Suspension system.

B. Tests: Air flow at scheduled static pressure.

C. Demonstrate:
1. Control Sequence.
2. Accessibility to components for service.

3.4 HOT AND CHILLED WATER CIRCULATING PUMPS

A. Mock-up one each system pump, completely installed including:
1. Pump mounted on housekeeping pad.
2. Auxiliary drain pan. (Chilled water only)
3. Piping to a point beyond the complete valve and instrumentation assemblies.
4. Strainers with blowdown.
5. Flexible piping connection.
6. Pipe supports.
7. Pipe insulation.
8. Pump painting.
9. Electrical connections.

3.5 PROTECTION OF EQUIPMENT

A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION 23 05 10

SECTION 23 05 12 HVAC SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by these specifications as outlined below.

B. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

C. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.

D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: ¼” = 1’-0”.

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
1. Actual mechanical equipment and components to be furnished
2. Service clearance
3. Relationship to other equipment and components
4. Roof drains and leader piping
5. Fire protection piping and equipment

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Related requirements:
1. Ductwork shop drawings
2. Coordination drawing specified in Division 26

F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, or NOT APPLICABLE. Explain all DO NOT COMPLY statements.

F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name, address and contact number.
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
   a. Contractor
   b. Subcontractor
   c. Supplier
   d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect/Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
2. Associated items which require correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make re-submittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a re-submittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule
   2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION 23 05 12

SECTION 23 05 13 ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.

B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:
1. Motors for mechanical equipment.
2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
8. Pipe heat tracing.
9. Cooling tower vibration switch/interlock/reset.
10. Field interlock wiring from chiller: flow switches, pump aux. Contacts, pump start/stop.
11. Power supply 120 VAC and control signal from chiller control panel to condenser water flow control valve installed in piping leaving chiller.
12. Wiring of all related circulating water system chemical treatment devices.
    a. Low voltage electric contacting water meter
    b. Solenoid valve/blow-down assembly
13. Radiant heater timer switches and/or thermostats
14. Low Voltage thermostat wiring

C. Refer to Division 23 Controls Sections for related control system wiring.

D. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.

E. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.

F. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 RELATED WORK

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

A. Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.

B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

A. Provide motors for mechanical equipment manufactured by one of the following:
1. Baldor Electric Company.
2. Century Electric Div., Inc.
3. General Electric Co.
4. Louis Allis Div.; Litton Industrial Products, Inc.
5. Lincoln Electric
6. Marathon Electric Mfg. Corp.
7. Reliance Electric Co.
8. Westinghouse Electric Corp.
9. WEG

B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of mechanical equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of mechanical work:

C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C temperature rise for continuous duty at full load (Class A Insulation).

D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.

E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.

F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.

G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
1. Frames. NEMA #56.
2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-

protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.

4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
5. Noise Rating: Provide "Quiet" rating on motors.

H. All motors shall be premium efficiency.

I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.

2.2 EQUIPMENT FABRICATION

A. Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

2.3 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.

B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.

B. Verify voltage with Electrical Plans.

END OF SECTION 23 05 13

SECTION 23 05 14 HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

A. Division 23 - Mechanical
1. Insulation
2. Fan/Coil Units
3. Air Handling Units
4. Chilled Water Pumps
5. Equipment Drain Pans

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

A. Type “L” copper with drainage pattern fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the system to facilitate easy removal.
1. Use threaded plugged tee at each change of direction to permit cleaning.
2. Install a cleanout every 50 feet of straight run piping
3. Maintain a positive slope on all piping

B. Install a water seal trap leg based on the fan pressure.
1. Size the length of the trap leg 1 inch larger than the actual system pressure.

C. Install traps and cleanout as shown in the drawing details.
1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS.

A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.

END OF SECTION 23 05 14

SECTION 23 05 17 HVAC ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, fire dampers, air distribution devices and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

A. 16-Gauge frames

B. 14-gauge steel panels

C. Continuous fully concealed hinges

D. Flush screwdriver cam lock & cylinder lock for Owner selection

E. Automatic closing and latching mechanism

F. Prime coat finish

G. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation

H. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

A. UL listed, 1-1/2 hour Label “B”, access doors

B. 16-Gauge stainless steel

C. 20-Gauge insulated sandwich-type door panel.

D. Two inch thick with fire rated insulation

E. Continuous fully concealed hinge

F. Automatic closing and latching mechanism

G. Knurled knob and recessed key operation for Owner selection

H. Interior latch release slide for opening from inside

I. Prime coat finish

J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

A. Milcor

B. MIFAB

C. Acudor

D. Elmdor

PART 3 - EXECUTION

3.1 INSTALLATION

A. Access doors specified in Division 23 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.

B. Installation shall be in accordance with the manufacturer's printed instructions.

C. Minimum size required:
   1. 36" x 24" for Mechanical HVAC equipment related items
   2. 18" x 18" for electrical related items

END OF SECTION 23 05 17

SECTION 23 05 18 VARIABLE FREQUENCY INVERTER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a variable frequency inverter for the following equipment items.
   1. Variable Volume Air Handling Units.
   2. Pumps.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Electrical Provisions of Mechanical Work.
   2. Air Handling Units
   3. Pumps
   4. Building Management Control System Sequences

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical to ensure that intended functions are achieved.

B. Coordinate the size of the variable frequency inverter with the equipment being served by the inverter. The rated current output amps are to be equal to or greater than motor rated full load amps.

1.4 SUBMITTALS

A. Submit manufacturer's information and shop drawings as specified.
   1. Complete technical details.
   2. Dimensions and manufacturer's installation manual.
   3. Schematic diagrams of the circuitry and field connections.
   4. Manufacturer's start-up manual.

1.5 STANDARDS

A. UL.

B. CSA.

C. ISO 9001

D. NEC.

E. FCC.

1.6 WARRANTY

A. The manufacturer shall provide a full parts and labor warranty for a period of five (5) years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ABB

B. Danfoss Graham

C. Yaskawa

2.2 CABINET

A. The inverter and all accessories shall be provided within a wall mounted UL Listed NEMA 1 enclosure in interior AHU mechanical rooms and in NEMA 12 enclosure with deadsides and removable hinged, gasketed doors with provisions for locking in all Plant locations. Cabinet shall be constructed of metal for reduction of radio frequency interference (RFI) and electromagnetic frequency interference.

2.3 INTERFERENCE WITH OTHER SYSTEMS

A. The inverter shall be designed and constructed to comply with IEEE Standard 519-1993 with respect to line noise and RFI generation. All units shall generate less than 3% total harmonic distortion back to the incoming power line at the point of common connection with sensitive equipment. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in Table 1.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.

B. Dual DC Bus filtered chokes (factory installed and wired in the drive enclosure) equivalent to 5% input line reactors shall be provided to minimize harmonics reflected onto the input line.
1. Shall not interfere with computer and other electronic systems in the building.
2. If not inherently protected, provide a suitable isolation transformer.
3. The system shall not produce spikes on the incoming line.

C. Any inverter that generates sufficient electrical line noise to interfere with the operation of sensitive building equipment shall be field modified or replaced by the inverter supplier at no additional cost to the Owner.

2.4 PROTECTIVE CIRCUITS

A. Provide the following protection:
1. Input line fuses or molded case circuit breaker rated at 100 AIC.
2. Input line noise suppression with MOV's (metal oxide varistors) and snubber circuits. MOV's shall be provided across incoming line terminals, AC input reactors, DC choke filters, and transistors to protect inverter from voltage surges and spikes.
3. Protection of solid state inverter devices by limiting output current to 110% of inverter rating, automatically prevent overcurrent trip due to momentary overload conditions.
4. Current limiting DC buss fuse between input and output sections of inventor.
5. Input overvoltage trip at 480 vac + 10% trip.
6. Input undervoltage at 480 vac – 10% trip
7. Instantaneous overcurrent protection of solid state inverter devices.
8. Individual overcurrent protection of solid state inverter devices.
9. Output overvoltage trip.

10. Loss of input phase, phase reversals, or blown fuse.
11. Thermal overload trip for overload protection of solid state devices.
12. Ground fault protection on start-up.
13. Output line to line short circuit protection.
14. Phase to phase short circuit or severe overload conditions of output.
15. Overload of motor.
16. Frequency stall.
17. DC buss high voltage.
18. Control function error.
19. Heatsink over temperature (Max. operating ambient: 122 degrees F)
20. Controller able to operate without a motor or any other equipment connected to the output (To facilitate startup and troubleshooting).
21. Capable of restarting into a rotating motor without component damage.
22. Shut down safely without component failure in the event of a sustained power loss, and will automatically return to normal operation, if start is "on" and power is restored.
23. Shut down safely without component failure in the event of a momentary power loss. Automatically return to normal operation if the start is "on", and normal power is restored. Capable of establishing speed control without shutdown or component failure.
24. Designed for input power contactor opening or closing while control is activated, without damage to the controller.
25. Automatically reset trip resulting from overcurrent, undervoltage, overvoltage, or over temperature, and automatically restart after removal, or correction of the faulty condition.
26. Provide status lights or digital display for indication of failure conditions, and form C relay provided for remote indication. Digital display or status lights to indicate power on, at speed, and drive enabled.
27. Operation and fault diagnostic function circuits shall be built into each inverter that provides information in determining the cause and source of a fault. Diagnostics to provide the following information:
    a. Operating mode at trip (Accel, Decel, Constant speed).
    b. Output current at trip.
    c. Output voltage at trip.
    d. Additional faults that occurred simultaneously of immediately before displayed tripped.

    Any drive requiring separate card to provide this information shall provide a diagnostic card for each drive.
28. DC link reactor.
29. Input power disconnect, lockable type.
30. Input power disconnect switch / circuit breaker, with lockable type handle.

2.5 OPERATOR DEVICES

A. The following operator devices shall be door or remote mounted:
1. Digital keypad and LCD provided to perform all parameter adjustments, operation monitoring, and operation programming.
2. Power on indication light.
3. Flush mounted meters or digital display to indicate output voltage, output frequency, and output current, in percent of maximum 0 to 100%.
4. Manual/Off/Auto 3 position selector switch (hand-off-auto) and manual speed setting control to provide the following control sequences:
    a. In automatic mode, controller shall follow an external control signal and respond to remote start-stop contact.
    b. In manual (hand) mode, controller shall follow speed signal set via door

mounted keypad and start/stop switch. Switching from “hand” to “auto” and vice versa shall require a single keystroke to a dedicated changeover key. Inverters requiring multiple keystrokes and/or reprogramming of internal parameters to accomplish changeovers are not acceptable.

c. An integral "safety interlock" protection shutdown circuit shall be provided for interface with firestats, smoke detectors, high static pressure limit switches, vibration switches, etc.

5. Programmable lockout code to prevent unauthorized programming.
6. Critical frequency avoidance capability (up to 3 resonant points).

2.6 FIELD ADJUSTMENTS

A. The following shall be adjustable in the field:
1. Maximum Speed: 0 to 125% adjustable.
2. Minimum Speed: 0 to 100% adjustable.
3. Acceleration/deceleration rates: 0 to 3600 sec.
4. Instantaneous overcurrent trip: 50% to 2000%.
5. Volts/hertz ratio: Field adjustable to 16 patterns or set for automatic selection of proper V/F load profile to operate motor without overdriving or overloading.
6. Current limit circuit: 60 to 100%.
7. Carrier frequency: 6 to 16 KHZ.
8. Control interface: selectable to follow a 0-5 VDC, 0-10 VDC, 4-20 MA, either direct or indirect acting.
9. Control signal Bias: 0 to 80 HZ.
10. Control signal gain: 0 to 80 HZ.
11. Calibration of remote speed signal: 0 to 80 HZ.

2.7 ELECTRICAL CONSTANT SPEED BYPASS

A. Provide all components and circuitry necessary to provide manual bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the "bypass" mode. Manual bypass shall contain the following:
1. Two contactors mechanically interlocked via a three position through the door selector switch to provide the following control:
a. "Inverter" Mode connects the motor to the output of the inverter.
b. "Bypass" Mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via thermal overload.
c. "Off" Mode disconnects motor from all input power.
2. A molded case circuit breaker or fused disconnect switch with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
3. An input contactor, interlocked with both the thermal motor overload and external safeties which disconnects power to the motor regardless of the mode of operation (either "inverter" or "bypass" mode).
4. A thermal overload to provide protection of motor in the bypass mode.
5. A safety interlock circuit that disconnects power to the motor (regardless of the mode of operation – “inverter” or “bypass”) in response to a signal from the thermal overload and/or external safety circuits.
6. Line voltage to 24 volt DC power source, fused per NEC, shall provide power to all bypass control circuits.

2.8 SERIAL COMMUNICATIONS

A. The VFD shall have the capability of communicating with the EMS control system via an RS-485 serial port.

B. VFD shall be provided with protocol information specific to the selected EMS control manufacturer and shall be pre-configured at the factory to automatic communications, without the need for field programming.

C. Serial communications capabilities shall be included, but not limited to: run/stop control, speed set adjustment, proportional/integral or PID control adjustments, current limit and accel/decel time adjustments. The drive shall also have the capability of allowing the DDC system to monitor the following feedback signals: process variable, output speed/frequency, current, torque, power (KW), operating hours, kilowatt hours; relay outputs, and diagnostic warning and fault information.

D. The VFD shall allow the DDC system to control the drive's digital and analog outputs and monitor all drive digital and analog inputs via the serial interface.

E. Provide BACnet interface card.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation as per manufacturer's recommendations and requirements.
1. Inverter chassis is properly grounded.
2. Line, Load, Control, and Fire/Safety wiring are installed in separate conduits.
3. Both ends of conduit entering and leaving VFD into AHU cabinets and motors must be sealed air tight.

3.2 MANUFACTURER START-UP SERVICE

A. Factory trained personnel shall be provided for start-up assistance, minimum (1) day per unit.
1. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents.
2. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.
3. Adjustable devices, components, and assemblies to assure optimum performance.
4. Make final adjustments to the installed drive to assure proper operation of the fan system. Obtain performance requirements from installer of driven loads.
5. Assistance will be provided to the Owner (upon request) to determine the optimum capacitance for per factory correction and avoidance of potential resonance problems and will determine optimum line filter required.
6. A written report, duly signed by the technician detailing set points of adjustable devices, amperages recorded, and any other pertinent data. This information is to be included in the operation and maintenance manual.

B. Input DC voltage to dry motor windings when fan is not in operation at the following locations:
1. Cooling tower fan motor

2. Motors downstream of coils
3. Rooftop unit motors

3.3 DEMONSTRATION AND TRAINING

A. Provide system demonstration to personnel, Owner, and/or Owner's selected representatives.

B. Demonstrate operation of controllers in the automatic and manual modes.

C. Provide a minimum of two days of technical training for the owner's operating and technical staff. Schedule training with owner's authorized representatives, during normal business hours and not less than 30 days prior to planned session.

D. Training may be consecutive or random, at Owner's option.

END OF SECTION 23 05 18

SECTION 23 05 19 HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

A. Division 23, Mechanical
1. 23 05 00 - Mechanical General Provisions
2. 23 20 00 - Pipe and Pipe Fittings, General
3. 23 05 23 - Valves, Strainers and Vents
4. 23 21 13 - Hot Water and Chilled Water Piping, Valves and Appurtenances

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

A. Trerice

B. Taylor

C. Marsh

D. Weksler

E. Marshalltown

F. Weiss

G. Miljoco

2.2 PRESSURE GAUGES

A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.

B. Dial: White aluminum with black markings

C. Window: Clear acrylic

D. Tube: Phosphor bronze and forged brass socket.

E. Gauge accuracy: +/- 1% over operating range.

F. For pulsating service, provide impulse dampers.

G. Without flange for pipe mounting.

H. With flange for wall mounting.

I. Weiss Model: LF44S-1B or equal.

2.3 THERMOMETER WELLS

A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction.

B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.

C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.

D. Wells shall be sized to extend a minimum of 50% into pipe.

2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

A. Die cast aluminum case with baked epoxy finish.

B. Adjustable angle 9" scale length.

C. Clear acrylic window.

D. Brass stem, length to match well.

E. Red reading organic spirit filled-in magnifying glass column.

F. White background with black figures and markings.

G. Brass stems and union connections.

H Accuracy: +/- 1% of scale range.

I. Range:
1. Hot water lines: 30°F to 240°F.
2. Chilled water lines: 0°F to 100°F or 120°F
3. Condenser water: 0°F to 100°F.

2.5 PRESSURE AND TEMPERATURE TEST STATIONS

A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel.
1. Fitted with a color coded cap strap with gasket.
2. Acceptable Manufacturer: Peterson Equipment Company.
3. Provide with extension neck to match insulation thickness.

B. Provide to the Owner a fitted case with:
1. Two 0-100 psi pressure gauges as specified and adapters with 1/8" OD probe.
2. Four 5" stem pocket testing thermometers.
   a. Two with range 25°F to 125°F for chilled water and condenser water.
   b. Two with range 0°F to 220°F for hot water.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with drawing details and manufacturer's recommendations.

B. Provide a ball valve at each gauge.

C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.

D. Install gauges in the following locations: across pumps, chiller cooler and condenser, storage tanks, heat exchangers.

E. Test wells for automatic temperature controls shall be furnished by Building Management Control Section and installed by Mechanical Contractor.

F. Install thermometer in the following locations: Across chiller cooler and condenser, storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, common chilled and hot water lines.
1. Hot water lines: 30°F to 240°F.
2. Chilled water lines: 0°F to 100°F or 120°F
3. Condenser water 0°F to 100°F.

END OF SECTION 23 05 19

SECTION 23 05 23 HVAC VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. HVAC Valves

B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

A. Pressure Ratings:
1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.

B. Butterfly Valves
1. Butterfly valves shall conform to MSS-SP67.
2. Liners, inserts and discs shall be suitable for the intended service.
3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.

C. Balancing Valves
1. Provide balancing valves with:
   a. Corrosion resistant plug with resilient seal when required.
   b. O-ring stem seal.
   c. Permanently lubricated, corrosion resistant bearings.
2. Connections
   a. Through 2" pipe size use threaded connections.
   b. For valves 2-1/2" pipe size and larger shall be provided with 150 psig flange connections.
3. Provide each valve with:
   a. Memory stop.
   b. Plastic drip cap.
   c. 1/8" gauge tap.

D. Ball Valves
1. Provide ball valves with:
   a. Blowout proof stem.
   b. Full size port, 316 stainless steel ball and stem.
   c. Cast bronze body.
   d. Threaded ends.
2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
3. Service rating:
   a. 150 psi saturated steam.
   b. 600 psi WOG.
4. Where piping is insulated, ball valves shall be equipped with 2” extended handles of non-thermal conductive material. Provide a protective sleeve that allows operation of

the valve without breaking the vapor seal or disturbing the insulation.

5. Provide with memory stop for balancing valves.

E. Valve Connections
1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
2. Thread pipe sizes 2" and smaller.
3. Flange pipe sizes 2-1/2" and larger.
4. Use screw to solder adapters for copper tubing.
5. Use grooved body valves with mechanical grooved jointed piping.

F. Valve Operators
1. Where butterfly valves are provided:
   a. Provide gear operators on valves 6" and larger.
   b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' above floor and hook to clips, arrange to clear walking space.
   c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4" and smaller.
   d. Provide worm gear operators on discharge side of pumps for balancing, for all sizes of valves.
   e. All valves 2-1/2” and larger provided by Milwaukee Valve shall be provided with gear operators.

G. Acceptable Manufacturers
1. Dezurik
2. Crane
3. Nibco
4. Keystone
5. Milwaukee Valve

H. Check Valves
1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
2. Iron body, 2-1/2" and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug.
3. Acceptable Manufacturers
   a. Mission Duochek
   b. Nibco
   c. Keystone
   d. Milwaukee Valve

I. Provide valves of same manufacturer throughout where possible.

J. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

K. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

L. Provide valve, seat and trim materials suitable for the intended service.

M. Provide memory stops for all valves used for throttling service. Valves for throttling service

shall be butterfly, plug, caged or ball type.

N. Condenser Water Basin Float Valve:
1. Ductile Iron valve, body and cover
2. Stainless steel trim
3. Fully adjustable high and low level settings
4. Stainless steel float, float linkage and float rod
5. Flow clean strainer
6. CV Flow Control for opening and closing
7. ASTM A 536, B16.42, 150# Class
8. Stilling well
9. Acceptable Manufacturer: CLA-VAL

2.2 PIPE SYSTEMS STRAINERS

A. Body:
1. "Y" pattern or basket as shown on the drawings.
2. Line size.
3. Threaded strainer blow down port.
4. ASTM A #126 Class B Cast Iron Body.

B. Construction:
1. 2" size and smaller with screw connections rated 400 psi WOG.
2. Over 2" size with flanged connections, rated 125 psi WOG.

C. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2".
2. With 0.45 perforations in piping systems 2-1/2" and 3".
3. With 0.125 perforations in piping systems 4" and larger.

D. Start-up:
1. Provide an additional fine mesh disposable screen for use during start-up operations.
2. Remove after 30 days.
3. Attach to piping for owners review.

E. Acceptable Manufacturers
1. Crane
2. Keckley
3. Zurn
4. Mueller
5. McAlear
6. Muesco

2.3 SUCTION DIFFUSER

A. For each pump as shown on the drawing, provide an angle type suction diffuser. Body is to fit both the pump inlet and suction pipe size.

B. Components:
1. Inlet straightening vanes.
2. Removable end cap.
3. Gauge ports.
4. Threaded strainer blow down port.
5. Adjustable support foot.

6. Removable magnetic insert.

C. The screen shall be as specified for pipe system strainers.

D. Provide an additional fine mesh disposable strainer for use during start up operations.
1. Remove after 30 days operation and all flushing is complete.
2. Attach to piping for owners review.

E. Construction:
1. 2" size and smaller with screw connections rated 400 psi WOG.
2. Over 2" size with flanged connections, rated 125 psi WOG.

F. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2".
2. With 0.045 perforations in piping systems 2-1/2" and 3".
3. With 0.125 perforations in piping systems 4" and larger.

2.4 VALVE SCHEDULE

A. Hydronic Service
1. Chilled Water Service
   a. Ball Valves up to 2": Nibco T-585-70-66 w/Nib-Seal insulated Handle
   b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
      Keystone Figure 222
2. Heating & Condenser Water Service
   a. Ball Valves up to 2": Nibco T-585-70-66
   b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000
      Keystone Figure 222
3. Check Valve:
   a. Nibco Check Valve: T - 413 - B
   b. Nibco Check Valve 2-1/2" and larger: F - 918 - B
   c. Nibco Check Valve 2-1/2" and larger: W - 920 -W (Wafer)
   d. Keystone Check 2-1/2" and larger: FIQ 810

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.

C. Use butterfly valves and ball valves in circulating water systems, for balancing duty. Provide infinite position gear operator with memory stop.

D. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
1. 1" valve for pipes 6" and larger.
2. 3/4" valve for pipes smaller than 6".
3. Terminate with pipe plug.
4. Drain valves shall be ball valves.

E. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not

damage the insulation.

F. Provide clearance for installation of insulation and access to valves.

G. Provide access where valves are not exposed.

H. Provide float valves / stilling wells in cooling tower or condenser water basins for water level control. Provide stilling wells around float valve to prevent turbulence ripples or wind interference.

I. Butterfly valves shall be installed per ASME B31.3 Process Piping, and ASME B16.5 Pipe Flanges and Flanged.

J. All isolation valves located above the ceiling shall be marked on the ceiling grid in a permanent manner.

3.3 PIPE SYSTEMS STRAINERS

A. Provide an additional fine mesh disposable strainer for use during start up operations.
   1. Remove after 30 days operation and all flushing is complete.
   2. Attach to piping for owners review.

B. Provide strainer in supply piping for all coil connections.

C. Provide strainer in condenser water piping entering chiller.

3.4 WATER SYSTEM AIR VENTS

A. Provide manual air vents at high points and at any other air pockets of closed circulating pipe systems. Extend 3/8" hard drawn copper tubing discharge drains to nearest floor or hub drain. Provide 1/4" Ball Valve as specified.

B. Where high point vents are not readily accessible provide additional valves at vent termination.

END OF SECTION 23 05 23

SECTION 23 05 33 HVAC PIPE HEAT TRACING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a complete industrial, constant wattage, UL listed system of electric pipe heat tracing and controls on all make-up water piping outdoors above grade to prevent freezing. The heat tracing system shall conform to ANSI/IEEE Standard 515-1989.

B. Protect the pipe, valves, fittings, meters and appurtenances. Apply sufficient cable and overheat thermostat to protect the entire system.

1.2 SUBMITTALS

A. Submit shop drawings and product data as specified in Section 23 05 12

B. Submit detailed calculations for length of heat tracing cable per foot of pipe, based on actual length of piping installed.

C. Submit manufacturer's certified capacity charts with selections plotted thereon.

D. Submit manufacturer's installation instructions.

E. Submit full load ampere requirement and voltage for branch circuit.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Raychem Corporation

B. Thermon Manufacturing Company

2.2 COMPONENTS

A. Self-regulating heater.
1. The self-regulating heater shall consist of two 16 AWG tinned-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heater to be crossed itself without overheating and to be cut in the field. The heater shall be covered by a radiation cross-linked modified polyolefin dielectric jacket.
2. In order to provide energy conservation, and to prevent overheating, the heater shall have a self-regulating factor of at least 90%.
3. The heater shall operate on a line voltage of 120 VAC without the use of transformers.
4. The heater shall be sized according to the following. The required heater output rating is in watts per foot at 50°F (heater selection based on 1-1/2 inch fiberglass insulation on metal piping).
5. The heater shall be XL-Trace as manufactured by Raychem Corporation or XL-Econotrace as manufactured by Thermon Manufacturing Company.
6. Power connection, end seal, splice and tee kits components shall be applied in the field.

7. The system shall be controlled by an ambient sensing thermostat set at 40°F either directly or through an appropriate contactor.
8. Provide an end-of-circuit voltage indicating light

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and start up the pipe heat tracing system in accordance with the manufacturer's Installation, Start-up and Service Instructions.

B. Install the pipe heat tracing cable under the pipe insulation.

C. Apply “Electrically Traced” signs to the outside of the thermal insulation.

D. Ground fault protection of the equipment shall be provided per the 1996 National Electrical Code, Article 427-22.

E. Provide a cast aluminum weatherproof NEMA-4 rated junction box for installation of the cable, with pilot light to indicate operation of the cable.

F. Use only electrical components as recommended by the manufacturer.

3.2 ELECTRICAL WORK

A. Furnish and install the wire, conduit and raceway systems required for the automatic operation of the pipe heat tracing system. Conform to the National Electrical Code.

B. The specified wiring work includes:
1. Wiring of control instruments between thermostat and junction boxes
2. Installation of thermostat and junction boxes
3. Wiring from the heat tracing cable to the junction boxes

C. Related branch circuit power wiring from the junction box to ground fault type circuit is specified to be provided in Division 26.

D. Provide devices and appurtenances as specified in Division 26.

E. Identify each circuit at each terminal with a separate tag.

F. Color code wires in accordance with IPCEA Standards.

G. Make all joints and connections with approved mechanical connectors.

3.3 TESTING OF THE PIPE HEAT TRACING SYSTEM

A. Test the pipe heat tracing system:
1. Simulate freezing outside air conditions
2. Measure the amperage draw of the heat tracing system
3. Compare to the manufacturer's capacity rating of the actual system

4. After installation and before and after installing the thermal insulation, subject heat to testing using a 1000 VDC megger. Minimum insulation resistance should be between 20 to 1000 megohms regardless of the length.

B. Submit records of test for approval prior to substantial completion; insert in the Owner's Manual.

END SECTION 23 05 33

SECTION 23 05 48 **VIBRATION ISOLATION**

PART 1 - GENERAL

1.1 SCOPE

A. Furnish, install, and adjust vibration isolation.

1.2 RELATED WORK

A. Division 23 Mechanical.
1. Refer to the Section on Ductwork for flexible connections between fans and ducts.
2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.3 SUBMITTALS

A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Amber Booth
B. Kinetics
C. Mason
D. Korfund
E. VSI.
F. Vibration Eliminator Co., Inc.
G. Metraflex

2.2 ISOLATOR TYPES

A. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.

B. Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or ¼ inch (6mm) neoprene acoustical friction pad between the base plate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height.

C. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from

side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

D. Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal Z section containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind forces. All directional neoprene snubber bushings shall be a minimum of 1/4 inch (6mm) thick. Steel springs shall be laterally stable and rest on 1/4 inch (6mm) thick neoprene acoustical pads. Hardware must be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous galvanized flexible counter flashing nailed over the lower curbs waterproofing and joined at the corners by EPDM bellows. All spring locations shall have access ports with removable waterproof covers. Lower curbs shall have provision for 2 inches (50mm) of insulation.

E. Flexible spherical expansion joints shall employ Peroxide cured EPDM in the covers, tubes and frictioning of the reinforcement. Reinforcement must be DuPont Kevlar. Solid steel rings shall be used within the raised face rubber ends to prevent pullout. No substitutions for the DuPont Kevlar or the solid steel embedded flange rings are acceptable. Sizes 2 inch (50mm) and larger shall have two spheres reinforced with a metal ring between spheres to maintain shape and complete with split ductile iron or steel flanges with hooked or similar interlocks. Sizes 16 inch (400m) to 24 inch (600mm) may be single sphere. Sizes 3/4 inch (20mm) to 1-1/2 inch (40mm) may have threaded bolted flange assemblies, one sphere and cable retention. 14 inch (300mm) and smaller connectors shall be rated at 250 psi (17 BAR) up to 190°F (88°C) with a uniform drop in allowable pressure to 190 psi (13 BAR) at 250°F (121°C). 16 inch (400mm) and larger connectors are rated 180 psi (12 BAR) at 190°F (88°C) and 135 psi (9 BAR) at 250°F (121°C). Safety factors to burst and flange pullout shall be a minimum of 3/1. All joints must have permanent markings verifying a 5 minute factory test at twice the rated pressure. Concentric reducers to the above specifications may be substituted for equal ended expansion joints.

High pressure joints shall be substituted for the above where operating pressures are higher than standard. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods. Control rods are not desirable in seismic work. If control rods are used, they must have ½- inch (12mm) thick Neoprene washer bushings large enough in area to take the thrust at 1000 psi (6.9 N/mm5) maximum on the washer area. Standard diameter bolt washers are not acceptable.

Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Chiller	A	0.35”
Pump (Above Grade)	B	1.5”
Suspended Fan Coil Units	C	0.5”

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Floor Mounted Fan Coil Units	A	0.35”
Condensing Units	A	0.35”
In-Line Fans	C	0.5”
Roof Mounted Condensing Units (<10 tons)	D	2”

2.4 PIPING ISOLATOR APPLICATIONS

EQUIPMENT	ISOLATOR TYPE
Floor Mounted Pumps	E
Suspended Pumps	E
Chiller Pipe Connections	E

2.5 FLEXIBLE CONNECTIONS IN PIPING AT PUMPS

A. Provide flexible connections at suction and discharge of chilled water, and hot water pumps, piping connections on chillers and where indicated on drawings. Refer to schedule above.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock of springs and isolators of type used so that changes required during construction and installation can be made.

B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION 23 05 48

SECTION 23 05 93 **TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS**

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Balance, adjust and test the air distribution system including the exhaust system.

B. Balance, adjust and test the hydronic system.

C. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

A. The work of this Section of the Specifications shall be paid directly by the Owner.

1.4 SUBMITTALS

A. History of the TAB organization.

B. Agency certification.

C. Personnel qualifications.

D. TAB data forms.

E. Instrumentation list.

F. Name of the project supervising engineer.

G. Name and address and contact person of five successfully completed projects of similar size and scope.

H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.

B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.

C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.

D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately

perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.

E. The balancing agency shall have operated for a minimum of five years under its current name.

F. Personnel:
1. The project supervisor shall be a Professional Engineer registered in Texas.
   a. Extensive knowledge of the work involved.
   b. At least five years experience conducting tests of the type specified.
   c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
2. All work shall be conducted under the direct supervision of the supervising engineer.
3. Technicians shall be trained and experienced in the work they conduct.

1.6 WARRANTY

A. Provide (AABC) guarantee in writing.

B. Extended warranty.
1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 TAB TOLERANCES

A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

3.2 SITE VISITS

A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.

B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a

reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.

C. Note proper piping installation, location of valves, and flow measuring instruments.

D. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.

E. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

3.3 TESTING INSTRUMENTS

A. Submit a list of all instruments to be used for the test and balance procedures.
1. Catalog sheets
2. Certificate of last calibration
3. Calibration within a period of six months prior to balancing

B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS

A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.

B. Make tests to verify proper placement of the static pressure sensors for the variable air volume fan system control.

C. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall provide all necessary software and special interface cables, as required, to communicate with the DDC system:
1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
2. Verify that all control devices are properly connected.
3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
7. Observe the calibration of all controllers.
8. Verify the proper application of all normally opened and normally closed valves.
9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
10. Observe the location of all sensors to determine whether their position will allow

them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.

11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
13. Check all dampers for free operation.
14. Verify that all controller setpoints meet the design intent.
15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.

D. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineers office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

3.5 INSTRUMENT TEST HOLES

A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:
   1. Drill holes, plug and tape external duct insulation.
   2. Repair damaged insulation to Engineer’s approval.

3.6 TESTING THE AIR DISTRIBUTION SYSTEM

A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set full open. The TAB agency shall perform the following TAB procedures in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
   1. Supply Fans:
      a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
      b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
      c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
      d. Outside Air: Test and adjust the outside air on applicable equipment using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical, use the mixed air temperature method, if the inside and outside temperature difference is at least 20°F, or use the difference between Pitot-tube traverse of the supply and return ducts.
      e. Static Pressure: Test and record system static pressure, including the static pressure profile of each supply fan.
   2. All Other Fans:
      a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
      b. Current and Voltage: Test and record motor voltage and amperage, and

compare data with the nameplate limits to ensure fan motor is not in or above the service factor.

c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.

d. Static Pressure: Test and record system static pressure, including the static pressure profile of each return fan.

3. VAV Terminal Units:
   a. Set and record volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
   b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.
4. Diffusers, Registers and Grilles:
   a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.
5. Coils (including electric coils):
   a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.

B. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.

C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.

D. Where air measuring stations are installed, use pitot tube traverse readings to verify and record the correct calibration of the stations output.

E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.

F. Measure and adjust all supply and return branches to design air delivery.

G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.

H. Make a set of recordings showing final system conditions.

3.7 TESTING THE HYDRONIC SYSTEMS

A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; that water has been flushed and is in a clean condition, and that all balancing valves (except bypass valves) are set full open. As applicable, check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards and all results shall be recorded in the TAB report:

1. Record preliminary pump data.

a. Pump RPM.
b. Pump shut-off differential head.
c. Pump operating differential head.
d. Check and verify pump alignment.
e. Verify impeller diameter.

B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as read from the manufacturer's pump curve and from a flow meter.

C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm, not the total of all the valves. Determine the diversity of the system and balance the individual coils with the maximum pump water quantity flowing in the system.

D. Balance flow through:
1. Chillers.
2. Coils.
3. Boiler.
4. Pumps
5. Condensers.
6. Cooling tower.
7. Heat Exchanger.

E. Use flow meters, differential pressures and temperature relationships as required.

F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full flow through the coil including the valve.

G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings showing final systems conditions.

H. Pumps:
1. Test and adjust pumps to meet design water flow requirements. Check pumps for proper operation. Pumps shall be free of vibration and cavitation Record appropriate gauge readings for final TDH and Block-Off\Dead head calculations. Check and verify pump alignment.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure pump motor is not in or above the service factor.

I. Coils:
1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within 5% of design flow requirements.
2. Verification: Verify the type, location, final pressure drop and water quantity (GPM) of each coil. Calculate the actual capacity of all coils. This information shall be recorded on coil data sheets.

J. Boilers:
1. Verify that boilers have been filled and started by others, and are in operation.
2. Current and Voltage: As applicable, test and record motor voltage and amperage, and compare data with the nameplate limits to ensure motor is not in or above the service factor.
3. Test, adjust and record water flows through water boilers.
4. Test and record water temperature profiles of each boiler.

K. Chillers:

1. Verify that chillers have been started by the manufacture and are in operation. Test and adjust chiller water flows to within 5% of the design requirements by using a U-TUBE manometer and setting balancing valves.
2. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure compressor motor is not in or above the service factor.
3. Test and record temperature profiles of each chiller at design water flow.

3.8 EQUIPMENT POWER READINGS

A. Record the following information for each motor:
1. Equipment designation.
2. Manufacturer.
3. Unit model number and serial number and frame.
4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
5. Heater coil in starter.
   a. Rating in amperes.
   b. Manufacturer's recommendation.
6. Motor RPM/driven equipment RPM.
7. Power reading (voltage, amperes of all legs at motor terminals).

3.9 BOILERS

A. Check for proper operation and with operation at near design conditions, record the following:
1. Manufacturer, model number, serial number and nameplate.
2. If water type, water flow in GPM, entering and leaving water temperature and water pressure drop in feet.
3. Type of fuel and heating value.
4. Rate of fuel consumption.
5. Capacity in MBH.
6. Efficiency.
7. Flue gas analysis.
8. Motor data.

B. Observe demonstration that all controls and safety devices are functioning properly. Record observations.

3.10 CHILLERS (Air Cooled)

A. Balance flow of water through each evaporator to be within a range of 100% to 110% of design flow with all pumps operating. With only one pump operating, the maximum flow shall not exceed the maximum tube velocity recommended by the manufacturer.

B. Verification of safety interlocks and controls are the responsibility of the manufacturer.

C. With each chiller operating at near design temperature conditions, measure and record the following:
1. Manufacturer, model number, serial number and all nameplate data.
2. Evaporator water entering temperature, leaving temperature, pressure drop (ft.) and water quantity (GPM).
3. Condenser air entering temperature, leaving temperature.
4. Evaporator and condenser refrigerant temperatures and pressures (using instruments furnished with the machine by the manufacturer).
5. Volts and amps for each phase.

6. Power factor.
7. KW input.
8. Tons of cooling.
9. KW per ton of cooling.

D. Reference chiller specification for additional requirements.

3.11 TESTING THE VARIABLE AIR VOLUME SYSTEM

A. All VAV boxes used are to be calibrated to produce the rated air quantity.

B. Set and record the supply air static pressure controller to provide actual design air flow at the most resistive terminal.

C. Measure and adjust the design air delivery at the inlet of each VAV box.

D. Measure and record the air quantity from each VAV box at its maximum flow. Manipulate the controller to achieve maximum flow.

E. Reset each box to yield and record minimum primary air flow.
1. DDC controllers record the correction factor required to establish actual desired air quantity as designed.
2. Pneumatic controllers adjust velocity controller as required to establish actual desired air quantity as designed.

F. If the box is operating with inlet static pressure in excess of the minimum cataloged pressure specified by the manufacturer and is not producing rated air quantity, field adjust the box to produce rated air quantity. Retest until approved results are obtained.

G. Position the VAV boxes to the proportion of maximum fan air volume to total installed box maximum volume.

H. Set the fan to deliver the AHUs scheduled design airflow.

I. Perform and record a total air traverse.

J. With the system terminal boxes set for full flow or diversity, the system will be delivering the scheduled design CFM with the most restrictive box in control. Make a speed increase if either or both static and volume are low.

K. Set the boxes to minimum and adjust the inlet vanes and or speed controllers to prevent excessive static in the system.

L. Coordinate with the work specified in Building Management and Control System on the final location of the sensors for the static pressure controller. Locate in the supply duct far enough from the fan discharge to be truly representative of the average static pressure in the system.

M. Modulate the fan speed on the supply fan. Adjust as required to coordinate with the static pressure sensing network.

N. Make a set of recordings showing final system conditions including system duct static pressures and control system setpoint.

3.12 DUCT TEST

A. Test and Balancing Contractor shall verify and record the duct test results. A copy of the duct test results, as completed, shall be submitted to the engineer for review within five days. Provide a complete report of all the duct test results in the final TAB report.

3.13 DIRECT EXPANSION EQUIPMENT

A. With each unit operating at near design conditions, measure and record the following:
   1. Manufacturer, model number, serial number and all nameplate data.
   2. Ambient temperature, condenser discharge temperature.
   3. Amperage and voltage for each phase.
   4. Leaving and entering air temperatures.
   5. Suction and discharge pressures and temperatures.
   6. Tons of cooling.
   7. Verification that moisture indicator shows dry refrigerant.

3.14 TAB REPORT

A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.

B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.

C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
   1. Title Page
      a. Company Name
      b. Company Address
      c. Company telephone number
      d. Project name
      e. Project location
      f. Project Manager
      g. Project Engineer
      h. Project Contractor
      I. Project Identification Number
   2. Summary of the TAB report data
   3. Index
   4. Instrument List
      a. Instrument
      b. Manufacturer
      c. Model
      d. Serial Number
      e. Range
      f. Calibration Date
      g. What test instrument is to be used for:
   5. Fan Data

a. Location
b. Manufacturer
c. Model
d. Air flow, specified and actual
e. Total static pressure (total external) specified and actual
f. Inlet pressure
g. Discharge pressure
h. Fan RPM

6. Return Air/Outside Air Data
   a. Identification/location
   b. Design return air flow
   c. Actual return air flow
   d. Design outside air flow
   e. Actual outside air flow
   f. Return air temperature
   g. Outside air temperature
   h. Required mixed air temperature
   I. Actual mixed air temperature
7. Electric Motors
   a. Manufacturer
   b. HP/BHP
   c. Phase, voltage, amperage, nameplate, actual
   d. PM
   e. Service Factor
   f. Starter size, heater elements, rating
8. V-Belt Drive
   a. Identification/location
   b. Required driven RPM
   c. Drive sheave, diameter and RPM
   d. Belt, size and quantity
   e. Motor sheave, diameter and RPM
   f. Center-to-center distance, maximum, minimum and actual
9. Duct Traverse
   a. System zone/branch
   b. Duct size
   c. Area
   d. Design velocity
   e. Design air flow
   f. Test velocity
   g. Test air flow
   h. Duct static pressure
   I. Air correction factor
10. Air Monitoring Station Data
    a. Identification/location
    b. System
    c. Size
    d. Area
    e. Design velocity
    f. Design air flow
    g. Test velocity
    h. Test air flow
11. Air Distribution Test Sheet
    a. Air terminal number
    b. Room number/location
    c. Terminal type

d. Terminal size
e. Correction factor
f. Design velocity
g. Design air flow
h. Test (final) velocity
i. Test (final) air flow

12. Pump Data
    a. Identification/number
    b. Manufacturer
    c. Size/model
    d. Impeller
    e. Service
    f. Design flow rate, pressure drop, BHP
    g. Actual flow rate, pressure drop, BHP
    h. Discharge pressure
    I. Suction pressure
    j. Total operating head pressure
    k. Shut off, discharge and suction pressures
    l. Shut off, total head pressure
    m. Pressure differential settings
13. Cooling Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Entering air WB temperature, design and actual
    g. Leaving air DB temperature, design and actual
    h. Leaving air WB temperature, design and actual
    i. Water pressure flow, design and actual
    j. Water pressure drop, design and actual
    k. Entering water temperature, design and actual
    l. Leaving water temperature, design and actual
    m. Air pressure drop, design and actual
    n. Capacity - sensible and latent
14. Heating Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Leaving air DB temperature, design and actual
    g. Water pressure flow, design and actual
    h. Water pressure drop, design and actual
    i. Entering water temperature, design and actual
    j. Leaving water temperature, design and actual
    k. Air pressure drop, design and actual
    l. Capacity
15. Electric Coil Data
    a. Identification/number
    b. Location
    c. Service
    d. Manufacturer
    e. Entering air DB temperature, design and actual
    f. Leaving air DB temperature, design and actual

g. Electrical Characteristics
h. Capacity

16. Sound Level Report
    a. Location (Location established by the design engineer)
    b. N C curve for eight (8) bands-equipment off
    c. N C curve for eight (8) bands-equipment on
17. Vibration Test on equipment having 10 HP motors or greater in size.
    a. Location of points:
        1) Fan bearing, drive end
        2) Fan bearing, opposite end
        3) Motor bearing, center (if applicable)
        4) Motor bearing, drive end
        5) Motor bearing, opposite end
        6) Casing (bottom or top)
        7) Casing (side)
        8) Duct after flexible connection (discharge)
        9) Duct after flexible connection (suction)
    b. Test readings:
        1) Horizontal, velocity and displacement
        2) Vertical, velocity and displacement
        3) Axial, velocity and displacement
    c. Normally acceptable readings, velocity and acceleration
    d. Unusual conditions at time of test
    e. Vibration source (if non-complying)
18. Control verification indicating date performed and any abnormalities identified.
    a. Point Location/Description
    b. EMS Readout (Setpoint and Actual)
    c. Actual Readout of all points
    d. Interlocks
    e. Safeties
    f. Variable speed drive tracking with EMS input
    g. Variable speed drive Bypass operation
    h. Sequence of operation

END OF SECTION 23 05 93

SECTION 23 05 94 COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.

B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS / NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

A. Bring the work to a state of readiness for testing, balancing, and adjusting.
1. Install air terminal devices.
2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
3. Verify lubrication of equipment.
4. Install permanent instrumentation.
5. Clean piping systems and fill with clean water.
6. Complete "Start-up" of equipment.
7. Check rotation and alignment of rotating equipment and tension of belted drives.
8. Verify ratings of overload heaters in motor starters.
9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
10. Provide control diagrams and sequence of operation.
11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
14. Comb out fins on extended-surface heat transfer coils where damaged.
15. Clean all strainers as required.
16. Remove construction strainers after water is cleaned and treated.
17. Remove all temporary filters from HVAC equipment.
18. Provide start-up reports listing all start-up information and manufacturer’s information attached.

B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.

C. Verify that the systems are ready for balancing and adjusting.

D. Submit a letter stating:
1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
2. Other equipment has been checked and started.
3. The systems have been operated for the specified period of time.
4. The automatic controls system has been adjusted, calibrated, and checked, and

is operating as specified.

E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.

F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.

G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.

B. Complete start-up of equipment prior to start of testing & balancing.

C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.

HVAC FAN / AIR HANDLING UNIT / START-UP REPORT FORM														
Equipment Description	*Actual*			*Disc. Switch Wired*	*Rotation Correct*	*Belt*		*RPM Correct Submittal*	*Vibration Isolation Correct*	*Attachment To Roof Curb*	*List Of Damage Parts*	*Bearings Lubricated*	*Filter Installed*	*Interlocks & Dampers Operational*
	Voltage	*Amps*	*HP*			*Condition & Part #*	*Tension Correct*							

END OF SECTION

SECTION 23 07 13 EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install external insulation on supply, return, exhaust and outside air ductwork.

B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

A. Division 9 - FINISHES. Painting and Color Coding.

B. Division 23 - MECHANICAL.
1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
3. Insulation. Refer to specific sections on individual insulation types.
4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.

C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated system is not approved.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.

B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 INSULATION

A. Glass fiber rigid duct insulation.
1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
2. Acceptable Manufacturers
   a. Schuller 814 spin-glas FSK.
   b. Owens-Corning Type 703 board RKF.
   c. Knauf 3 PCF FSK.

B. Glass fiber blanket duct insulation.
1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
2. Acceptable Manufacturers
   a. Manville R-series Microlite FSKL.
   b. Owens-Corning ED100 RKF.
   c. Knauf 1.0 PCF FSK.

C. Fiberglass reinforcing cloth mesh.
1. Acceptable Manufacturers
   a. Perma Glass Mesh.
   b. Alpha Glass Mesh.
   c. Childers Chil-Glas #10
   d. Foster Mast a Fab
   e. Vimasco.

D. Mastics, sealants, coatings and adhesives.
1. Acceptable Manufacturers
   a. Childers.
   B. Foster.
   c. Vimasco.

E. Fireboard Insulation

1. Totally encapsulated with foil facing.
2. Two hour rated fire protection.
3. Zero clearance to combustible protection.
4. System shall be listed and labeled by an NRTL.
5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
7. Acceptable Manufacturers
   a. Unifrax ON Fyrewrap Elite 1.5
   b. Partak Insulation, Inc. Paroc Fireboard
   c. Thermal Ceramics FireMaster 3M
   d. Premier Refractories International, Pyroscat.

F. Rigid Closed Cell Insulation
1. Acceptable Manufacturers
   a. Dow Trymer.
   b. Phenolic Foam.

G. Reinforced Foil Tape
1. Acceptable Manufacturers
   a. Venture 1525CW
   b. 3” FSK
2. Thickness 6.5 mils
3. Color: silver

2.2 COATING AND ADHESIVE

A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.

B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249.

C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.

D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

2.3 OUTDOOR DUCT LAMINATED JACKETING

A. Rubberized bitumen compound material:
1. Ultraviolet resistant
2. Weatherproof
3. Vapor retarding jacketing
4. Laminated jacketing
5. Cross-laminated high strength polyethylene film
6. Laminated to aluminum foil
7. Minimum 60-mil thickness

B. Acceptable Manufacturers:
1. Alumaguard 60
2. Flex Clad 400
3. Venture Clad 1577CW

PART 3 - EXECUTION

3.1 FIRE SAFETY REQUIREMENTS

A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

3.2 CONCEALED DUCT

A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.

B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2” thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.

C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2”. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.

D. On circumferential joint, the 2” flange on the facing shall be stapled with 9/16” outward clinch steel staples on 2” centers and taped using 3” wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.

E. Ductwork in mechanical rooms is considered concealed spaces.

3.3 EXPOSED DUCT INSULATION

A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
1. Apply fabric and mastic to provide a smooth surface for painting.

B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.

C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.

D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

3.4 OUTDOOR DUCTWORK COVERING

A. Cover all supply and return ductwork outdoors:
1. 1-1/2” thick, rigid closed cell insulation with reinforced foil facing.

B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.

C. Impale the insulation over mechanical fasteners and washers.
   1. A minimum of 2 rows of fasteners per side on 12-inch centers.
   2. Seal all breaks, joints and punctures by applying a 1/8” thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.

D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4”.

E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
   1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4”.
   2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8”.
   3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
   4. Aluminum gray or white finish as approved by the Architect.

F. Standing water on horizontal surfaces is not approved.

G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

A. Secure fireboard insulation to duct with impaling pins and 3” square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12” centers.

3.6 GENERAL INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Apply insulation on clean, dry surfaces only.

C. Continue insulation with vapor barrier through penetrations.

D. Neatly finish insulation at supports, protrusions and interruptions.

E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.

F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not

visible after completion.

G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION 23 07 13

SECTION 23 07 16 VESSEL INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install insulation for both high and low temperature vessels.

B. Low temperature installations include expansion tanks, air eliminators, chiller nozzles, chiller heads and other vessels containing liquids 60°F and below.

C. High temperature installations include expansion tanks, air eliminators, domestic water storage tanks, boiler stack / transition and other vessels containing liquids above 60°F.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.

C. All vessel insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated vessel system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation, also repair any damage caused by the condensation.

F. Where existing insulated vessel, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

A. Division 9 Finishes. Painting and color-coding

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe & tank insulation:
   1. Schuller Type 817
   2. Owens-Corning Type 705
   3. Knauf 2.8 PCF

B. Closed cell, non-wicking pipe & tank insulation:
   1. Armaflex FS, 2” thickness

C. Aluminum Jacketing:
   1. Childers
   2. Pabco
   3. RPR

D. Monel Staples
   1. Bostich Monel
   2. Duo-Fast Monel
   3. Markwell Monel

E. Fiberglass reinforcing cloth mesh:
   1. Perma Glass Mesh
   2. Alpha Glass Mesh
   3. Childers Chil-Glas
   4. Foster Mast a Fab

F. Weather Resistant Coating:
   1. WB Armaflex Finish

2.2 CEMENT, MASTICS, SEALANTS, ADHESIVES AND COATINGS

A. Adhesive: Provide Childers CP-127 or Foster 85-60 fiberglass adhesive to seal insulation for low temperature vessels.

B. Adhesive / Joint Sealant: Provide Armaflex 520 adhesive to seal insulation for low temperature vessels.

C. Lagging Adhesive / Coating: Furnish Childers CP50AHV2 or Foster 30-36 lagging adhesive / coating to provide a finish coat and to secure finish cloth for high temperature vessels.

D. Insulation Joint Sealant: Use Childers CP-76 or Foster 95-50 to seal the joints of insulation on low temperature vessels.

E. Metal Jacketing Sealant: Use Childers CP-76 or Foster 95-44 on all metal jacketing laps outdoors.

F. Vapor Barrier Coating: Indoors - Use Childers CP-38 or Foster 30-80 vapor barrier coating finish to coat the canvas finish on low temperature vessels. Permeance shall be 0.013 perms or less as tested by ASTM E96. Coating must comply with MIL-C-19565C, Type II and be QPL listed. Permeance shall be 0.03 perms or less at 30 mils, dry. Tested at 100°F and 90% RH per ASTM F 1249 and by Hypalon rubber based.

G. Weather Barrier Mastic: Furnish Childers CP-10/11 or Foster 46-50 weather barrier mastic and reinforcing mesh for outdoor finish.

H. Reinforcing Mesh: Furnish 10 X 10 white glass or polyester reinforcing mesh.

PART 3 - EXECUTION

3.1 HIGH TEMPERATURE VESSELS (FIBERGLASS)

A. Apply a first layer of insulating board. Band the board on immediately after application, using bands on 12” centers, drawn tight and securely fastened.

B. Apply successive layers of insulation as specified for the first layer, with joints staggered. After insulation has been applied, finish with Childers CP-38 or Foster 30-80 vapor barrier coating reinforced with glass or polyester reinforcing mesh per manufacturer's recommendations. Provide a flood coat of Childers CP-10/11 or Foster 46-50 with Foster Mast a Fab polyester or Chil Glas #10 reinforcing mesh.

C. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with glass fiber wall cavity insulation.

3.2 LOW TEMPERATURE VESSELS (CLOSED CELL)

A. Apply a layer of insulating board. Band the insulation on immediately after application, using bands on 12” centers, drawn tight and securely fastened.

B. To insulate removable heads, provide two equal sections of heavy-gauge, galvanized sheet metal covers, angle reinforced and lined with insulation board. Make covers easily removable to allow free access to the heads for inspection, cleaning and dismantling. Provide suitable flanges on the sections with neoprene gaskets between them, permitting a tight seal when the two sections are bolted together. Fill the voids with closed cell insulation.

C. Apply weather protective finish on closed cell insulation. Provide a minimum of three coats.

3.3 ALUMINUM JACKETING (Insulated vessels outdoors above grade)

A. Apply aluminum jacket on vessels according to manufacturer's recommendations using aluminum strapping and metal jacketing sealant to provide weather tight covering.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function.

C. Install straps on 12” centers.

3.4 VESSEL INSULATION REQUIREMENTS

A. Insulate all low and high temperature vessels located exterior (outside) of the building, including the following:
   1. Air separators
   2. Expansion Tanks
   3. Chemical feeders
   4. Chilled water system volume tanks
   5. Insulation thickness shall match thickness of adjoining pipe insulation

B. Insulate all low temperature vessels located interior (inside of the building, including the following:
   1. Air separators
   2. Chemical feeders
   3. Chilled water system volume tanks
   4. Insulation thickness shall match thickness of adjoining pipe insulation

C. Insulate the following high temperature vessels located interior (inside the building).
   1. Air Separators
   2. Insulation thickness shall match thickness of adjoining pipe insulation

D. As indicated on the drawings

END OF SECTION 23 07 16

SECTION 23 07 19 HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including chilled water, heating water, refrigerant lines, condensate piping and make-up water.

1.2 QUALITY ASSURANCE

A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.

B. An approved contractor for this work under this Division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.

C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.

D. Condensation on any insulated piping system is not acceptable.

E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.

F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 SUBMITTALS

A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.

B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

A. Finishes. Painting and color-coding

B. Pipe Heat Tracing

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass fiber pipe insulation:
1. Johns-Manville Micro-Lok AP-T
2. Owens-Corning ASJ/SSL
3. Knauf ASJ/SSL

B. Cellular Glass Insulation (Foamglass):
1. Pittsburg Corning
2. Cell-U-Foam

C. Rigid Foam Insulation:
1. Kingsapan Tarec
2. Dow Trymer
3. Tarec Ecophen – Phenolic Foam

D. Aluminum Jacketing:
1. ITW Lock-on (Childers)
2. ITW Z-lock (Pabco)

E. Fiberglass reinforcing cloth mesh:
1. Perma Glass Mesh
2. Alpha Glass Mesh
3. Childers Chil-Glas
4 Foster Mast a Fab
5. Vimasco

F. Mastics, Sealants, Coatings and Adhesives
1. Childers
2. Foster
3. Vimasco
4. Armacell 520 Adhesive

G. Elastomeric Insulation
1. Armacell

H. Weather Resistant Coating
1. WB Armaflex Finish
2 Foster 30-64

I. Glass fiber blanket insulation
1. Manville R-series Microlite FSKL
2. Owens-Corning eD75 or ED100 RKF
3. Knauf 0.75 PCF FSK

2.2 RIGID FOAM PIPE INSULATION

A. Polyisocyanurate pipe insulation or phenolic foam pipe insulation, with all service reinforced vapor barrier jacket having integral laminated vapor barrier.
   1. Polyisocyanurate: Thermal conductivity 0.14 @ 75°F mean (ASTM C518).
   2. Phenolic Foam: Thermal conductivity 0.13 @ 75°F mean (ASTM C 518); minimum 2.5# density.
   3. Polyisocyanurate is not to be used inside of buildings without 25/50 rating.

2.3 FIBERGLASS PIPE INSULATION

A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
   1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

2.4 ELASTOMERIC INSULATION

A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than ¾" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.
   1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

2.5 CELLULAR GLASS INSULATION

A. ASTM C552:
   1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
   2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

2.6 INSULATION/SHIELD AT HANGERS

A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.
   1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
   2. Minimum thickness of foam glass insulation shall not be less than 1" thick.

B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

2.7 SEALANT, ADHESIVE AND FINISH

A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.

B. Vapor Barrier Finish:
   1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.
   2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100ºF and 90% RH per ASTM F 1249 and must be Hypalon rubber based.
   3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.

C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.

D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.

E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.

F. Other products of equal quality will be acceptable only upon approval.

2.8 ALUMINUM JACKETING

A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016” thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.

B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024” thick.

C. Straps and Seals. Provide ½” x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

2.9 GLASS FIBER BLANKET INSULATION

A. Minimum density of 1.0 PCF, 2” thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

PART 3 - EXECUTION

3.1 INTERIOR PIPING

A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3” wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-38 or Foster 30-80 vapor barrier coating for chilled water piping applications.

B. Cover all chilled water piping with rigid foam insulation.
   1. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
   2. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82

adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.

3. Apply a tack coat of fitting mastic over the insulation and tape.
4. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
5. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
6. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

B. Install hanger with protective shield, on the outside of all insulation.

C. Where domestic water pipes (1/2" & ¾" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.

D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.

E. Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.

F. Apply a smooth flood coat of white lagging adhesive Foster 30-35 or Childers CP-35 over all exposed insulation within mechanical rooms.

G. Piping to be insulated as specified above:
1. Chilled water and heating water
2. Make-up water
3. Horizontal sanitary drain piping that receives condensate
4. Condenser water

3.2 REFRIGERANT AND CONDENSATE PIPING

A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster 85-75, Childers CP-82 or Armstrong 520 Adhesive.

B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.

C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.

D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.

E. Outdoor exposed piping after being sealed as noted above apply aluminum jacketing to protect piping insulation exposed to weather, from damage from sunlight, moisture,

equipment maintenance, wind, and shall provide shielding from solar radiation. Adhesive Tape shall not be permitted.

3.3 PIPING OUTDOORS ABOVE GRADE

A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.

B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.

C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using Childers CP-82 or Foster 85-20 adhesive. Secure fitting insulation covers and segments in place with ½" wide glass filament tape.

D. Apply a tack coat of fitting vapor barrier coating over the insulation and tape.

E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.

F. Apply coating over the fiberglass cloth to a thickness where the mesh is not visible after completion.

G. Seal ends of pipe insulation with vapor barrier coating at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.

H. Finish with aluminum jacketing as specified.

3.4 UNDERGROUND PIPE COVERING

A. Cover chilled and hot water piping underground with cellular glass insulation.

B. Butter insulation joints with Childers CP-76 or Foster 95-50 vapor barrier sealant. Secure with stainless steel bands or ½" fiberglass reinforced tape on 9" centers.

C. Cover valves and flanges with fabricated fittings of thickness and material equal to the adjoining insulation. Fasten fittings in place with stainless steel bands or ½" fiberglass reinforced tape.

D. Apply a tack coat of fitting mastic Childers CP-22/24 or Foster 60-25/26 over the insulation and bands.

E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.

F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.

G. Seal ends of pipe insulation with vapor barrier mastic at all valves, fittings, flanges and every 21' on straight run piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe, making a complete seal.

H. Finish with 125 mil thickness Pittwrap jacket applied in accordance with manufacturer's instructions. At contractor's option, cover insulation with Servi-Wrap P-500 installed in accordance with manufacturer's instructions.

3.5 FLANGE, VALVE AND FITTING INSULATION

A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
   1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
   2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
   3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2” on adjoining sections of pipe insulation.
   4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
   5. Apply coating/mastic to a wet film thickness of 3/64”.
   6. Fabric shall not be visible after completion.
   7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100ºF and 90% RH per ASTM E96.

B. PVC fitting covers are not acceptable.

3.6 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.

B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3” to make a weather tight seal with the application of 1/8” bead of Childers CP-76 or Foster 95-44 metal jacketing sealant.

C. Install straps on 9” centers and at each circumferential lap joint.

D. Cover and seal all exposed surfaces.

E. The use of screws and rivets is not approved.

F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.7 MISCELLANEOUS

A. Insulate pumps.

B. Install materials after piping has been tested and approved.

C. Apply insulation on clean, dry surfaces only.

D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.8 INSULATION THICKNESS

THICKNESS

INSULATED UNIT	(Inches)
Refrigerant Piping	1-1/2
Chilled Water Piping (through 2” pipe)	1-1/2
Chilled Water Piping (2-1/2” pipe and Larger)	2
Condensate Drains	1
Heating Water Piping 2” Pipe and Larger	2
Heating Water Piping 1-1/2” Pipe and Smaller	1-1/2
Exterior Chilled and Hot Water Piping, 5” Pipe and Larger	2
Exterior Chilled and Hot Water Piping 4” Pipe and Smaller	1-1/2

END OF SECTION 23 07 19

SECTION 23 08 00 MECHANICAL COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section outlines commissioning requirements and activities of Contractor, Owner, CxA and Design Professionals as related to the Division 23 Mechanical.

B. Related Sections:
1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
2. Division 22 – Plumbing
3. Division 23 – Mechanical
4. Division 26 – Electrical

1.2 DEFINITIONS

A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTACT INFORMATION

A. The Owner will contract directly for commissioning services.
1. Commissioning Agent fee will be paid for directly by the owner.
2. Cost of contractor coordination with the CxA is specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment required for Functional Performance Testing including, but not limited to equipment listed below. Data logging equipment and software required to test equipment shall be provided by the Contractor.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 1.0ºF and a resolution of + or - 0.2ºF). Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and following any repairs to the equipment. Calibration tags shall be affixed or certificates readily available.

C. Test equipment includes:
1. Air flow measuring devices (hoods, anemometers, etc.)
2. Water flow measuring devices
3. Temperature measuring devices (air and water)
4. Humidity sensors
5. Pressure gauges (air and water)
6. CO2 sensors

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT

A. Ladders and/or lifts and appropriate fall protection as required by Contractor site requirements.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

A. Except for the activities to be performed by the CxA called for herein, all component and system installation work required by the Division 22, 23 and 26 specifications including specific contractor furnished items indicated by this Section shall be provided by the Contractor.

3.2 SUBMITTALS

A. Mechanical
1. Ductwork Layouts
2. Piping Layouts
3. Equipment Room Layouts
4. Mechanical Equipment as needed

3.3 EQUIPMENT START-UP

A. Notification
1. Contractor shall provide ten Owner business days' notice to CxA, Owner and Design Team of start-up dates.

B. Prior to start-up, contractor shall:
1. Verify that equipment and systems are complete, accessible, correctly connected to utilities and ready for operation. Perform all pre-start inspections and tests as called for in Division 23.
2. Comply with pre-start requirements of manufacturer and complete applicable documentation.
3. Complete applicable sections of Prefunctional Checklists.
4. Coordinate start-up attendance by manufacturer or authorized representative as required by specifications or manufacturer.

C. At start-up, contractor shall:
1. Supervise the activities of the authorized start-up technician or manufacturer's representative.
2. Verify proper voltage, phase, overcurrent protection, drive rotation and any other conditions that may cause damage if not correct.
3. Execute start-up under supervision of qualified contractor and equipment manufacturer personnel and in accordance with the manufacturer's instruction.
4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
5. Complete PFC's and provide documentation to CxA.
6. Provide documentation of any issues noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action.

3.4 PIPE AND DUCT PRESSURE/LEAKAGE TESTING

A. General
1. The following procedures are meant as general procedures and do not alleviate

Contractor of more stringent procedures specified elsewhere in Division 23.

B. Notification
1. Contractor shall provide adequate notice to CxA, Owner and Design Team of testing dates.

C. Duct Pressure Testing:
1. Prior to testing, contractor shall:
a. Select duct sections with approval by Design Team.
b. Calculate duct areas and acceptable leakage rates.
c. Verify that test equipment is of appropriate capacity for duct sections tested. Ideally, the pressure testing equipment will be at the midpoint of the system tested.
d. Verify that test equipment has been calibrated with NIST traceable certificates within the past 12 months or shorter time span if specified elsewhere in Division 23.
e. Isolate and seal duct sections.
2. During testing, contractor shall:
a. Conduct testing in a safe manner.
b. Operate test equipment at a minimum of 3” wg for ductwork between AHU and terminal unit, or as specified elsewhere in Division 23.
c. Operate test equipment at a minimum of 2” wg for ductwork downstream of terminal units and exhaust ductwork, or as specified elsewhere in Division 23.
d. Record all applicable test data.
3. Upon completion of testing, contractor shall:
a. Remedy sections that do not pass and schedule a retest.
b. Submit test results to Owner, Design Team and CxA for review.

D. Pipe Pressure Testing
1. Prior to testing, contractor shall:
a. Verify that test equipment has been calibrated with NIST traceable certificates within the past 12 months or shorter time span if specified elsewhere in Division 23.
b. Isolate and seal pipe sections to be tested.
c. Isolate equipment or apparatus connected to the piping system that may be damaged during the testing.
d. Clean and flush piping sections and fill with clean water, venting all air.
e. Allow adequate time for water and piping to reach ambient temperature.
2. During testing:
a. Maintain a safe condition in the area surrounding the test system.
b. Pressurize piping to 150% of design working pressure, but not greater than piping design pressure.
c. Pipe shall hold pressure for minimum of 2 hours.
d. Record temperature of piping and ambient air at beginning and end of test.
e. Record pressure on piping system at beginning and end of test.
3. Upon completion of testing, contractor shall:
a. Remedy sections that do not pass and schedule a retest.
b. Submit test results to Owner, Design Team and CxA for review.

3.5 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall forward completed copies of PFCs to the CxA for inclusion into the Cx documentation. PFCs will be provided by the CxA. As an alternate, contractor shall submit their versions of the PFCs to the CxA for review and comment.

B. Contractor shall complete PFC for each of the following equipment:
   1. Mechanical:
      a. Air Handling Units
      b. Energy Recovery Units
      c. Terminal Units
      d. Pumps
      e. Fans
      f. Heaters
      g. Split Systems
      h. Chiller
      i. Boiler
      j. Valves

3.6 TEST AND BALANCE

A. Contractor shall forward the T&B Execution Plan to the CxA prior to performing the field T&B activities. CxA will review and comment on Plan.

B. Contractor shall notify CxA a minimum of three (3) days prior to conducting field T&B activities. Failure to provide CxA with adequate notification may result in additional field time by T&B Contractor to demonstrate T&B results.

C. Key T&B activities that CxA requires notification on:
   1. Terminal Units.
   2. Air Handling Unit.
   3. Energy Recovery Unit.
   4. Pumps.

3.7 FUNCTIONAL TESTING

A. General
   1. Contractor shall organize and schedule Construction Team members to execute the functional testing, which will be directed by CxA. Construction Team members may include Mechanical Sub, T&B Sub, Controls Sub, Electrical Sub, Fire Alarm Sub or Plumbing Sub. Contractor shall note that certain activities, such as sensor calibration, can be organized so that the T&B Sub is scheduled efficiently.

C. Air Cooled Chillers
   1. Graphics
   2. Start/Stop/Schedule
   3. Compressor Operation (On/Off/Hand/Auto)
   4. Entering/Leaving Temperature
   5. Safeties
   6. Alarms
   7. Temperature Reset Sequences

D. Boilers
   1. Graphics
   2. Start/Stop/Schedule
   3. Firing Operation (On/Off/Hand/Auto)
   4. Entering/Leaving Temperature
   5. Safeties
   6. Alarms
   7. Temperature Reset Sequences

E. Air Handling Units
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration (Air/Water)
5. Damper Positions (Off/On/Safety)
6. Valve Positions (Off/On/Safety)
7. Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
8. Alarms (Filter/Temperature/etc.)
9. Damper Operation (Normal/Economizer)
10. Valve Operation (Normal Heating & Cooling/Economizer)
11. Fan Speed Control (VFD)
12. Temperature Reset Sequences
13. Static Reset Sequences

F. Energy Recovery Units
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration (Air/Water)
5. Air Flow Station Calibration
6. Damper Positions (Off/On/Safety)
7. Valve Positions (Off/On/Safety)
8. Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
9. Alarms (Filter/Temperature/etc.)
10. Damper Operation (Normal/Economizer)
11. Valve Operation (Normal Heating & Cooling/Economizer)
12. Fan Speed Control (VFD)
13. Temperature Reset Sequences
14. Static Reset Sequences

G. Terminal Units
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration (Air/Water)
5. Thermostat Operation
6. Damper Positions (Off/On/Safety)
7. Valve Positions (Off/On/Safety)
8. Safeties (Smoke Detectors/Fire Alarm)
9. Alarms (Temperature/etc.)
10. Unoccupied Overrides

H. Pumps
1. Graphics
2. Start/Stop/Schedule
3. Pump Operation (On/Off/Hand/Auto)
4. Flow Station Calibration
5. Pressure Sensor Calibration
6. Pump Speed Control (VFD)
7. Sequencing and Alarms

I. Fans
1. Graphics

2. Start/Stop/Schedule
3. Thermostat Operation
4. Flow Station Calibration
5. Pressure Sensor Calibration
6. Speed Control (VFD)
7. Sequencing and Alarms

J. Heaters
1. Graphics
2. Start/Stop/Schedule
3. Thermostat Operation
4. Flow Station Calibration
5. Sequencing and Alarms

K. Split Systems
1. Graphics
2. Start/Stop/Schedule
3. Fan Operation (On/Off/Hand/Auto)
4. Temperature Calibration
5. Thermostat Operation
6. Safeties (Low Limit/Smoke Detectors/Fire Alarm/Static Pressure)
7. Alarms (Filter/Temperature/etc.)
8. Fan Speed Control (VFD)

L. Recirculation Pump
1. Graphics
2. Start/Stop/Schedule
3. Pump Operation (On/Off/Hand/Auto)
4. Temperature Sensor Calibration

3.8 TREND DATA

A. Contractor shall enable trend data as indicated herein and as specified by contract documents and Owner's requirements. Trends shall be stored to a repository device that can be recalled at any time period. Sampling rate shall vary based upon the trend and may range from change of value (COV) to a maximum of 15 minutes.

B. Ambient (Outdoor) Conditions
1. Dry Bulb Temperature
2. Wet Bulb Temperature
3. CO2 Level

C. Building Loop Chilled Water System
1. Chilled Water Flow.
2. Chilled Water Supply Temperature.
3. Chilled Water Return Temperature.
4. Chilled Water Pressure Differential.
5. Chilled Water Pressure Setpoint.
6. Pump 1 Speed.
7. Pump 2 Speed.

D. Building Loop Hot Water System
1. Hot Water Flow.
2. Hot Water Supply Temperature.
3. Hot Water Return Temperature.

4. Hot Water Pressure Differential.
5. Hot Water Pressure Setpoint.
6. Pump 1 Speed.
7. Pump 2 Speed.

E. Air Handling Unit Supply Air
1. Supply Air Temperature.
2. Supply Air Temperature Setpoint.
3. Mixed Air Temperature.
4. Mixed Air Temperature Setpoint.
5. Chilled Water Valve Position.
6. Hot Water Valve Position.
7. Critical Terminal Unit Air Valve and Heating Position

F. Air Handling Unit Static Pressure
1. Duct Static Pressure.
2. Duct Static Pressure Setpoint.
3. Fan Speed
4. Critical Terminal Unit Air Valve Position

G. Air Handling Unit Economizer
1. Supply Air Temperature.
2. Supply Air Temperature Setpoint.
3. Mixed Air Temperature.
4. Mixed Air Temperature Setpoint.
5. Return Air Temperature.
6. Return Air Enthalpy.
7. Outside Air Temperature.
8. Outside Air Enthalpy.
9. Chilled Water Valve Position.
10. Hot Water Valve Position.
11. Return Damper Position
12. Relief Damper Position
13. Outside Air Damper Position

H. Terminal Units
1. Room Temperature.
2. Room Temperature Setpoint.
3. Supply Air Temperature.
4. Inlet Air Flow.
5. Inlet Air Valve Position.
6. Heating Coil Valve Position.
7. Fan Status.
8. Room CO2.

I. Split System Units
1. Room Temperature.
2. Room Temperature Setpoint.
3. Supply Air Temperature.
4. Fan Status.
5. Cooling/Heating Mode.

J. Fans
1. Room Temperature.
2. Room Temperature Setpoint.

3. Fan Status/Speed.

K. Heaters
1. Room Temperature.
2. Room Temperature Setpoint.
3. Status.

END OF SECTION 23 08 00

SECTION 23 09 33 BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

A. Provide and install a complete Building Management and Control System (BMCS), including industrial instrumentation necessary to obtain functions and results specified. A complete system includes items such as sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.

B. Temperature Control System components:
1. Electronic instruments as specified
2. Electric instruments as specified
3. Microcomputer instruments as specified

C. All control devices of the same type product shall be of a single manufacturer.

D. Control, power and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.

E. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.
1. All components and elements
2. The testing and acceptance procedure

F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

G. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
1. All components and elements.
2. Start-up and point verification.
3. The testing and acceptance procedure.

H. No portion of the total contract will be substantially complete unit the automatic temperature control system has been demonstrated to be complete and functioning as intended. The temperature control system will be complete and functioning as intended when all of the space temperatures are maintained at plus or minus two degrees of setpoint.

I. The cost of the work specified in this section is included in an allowance.
1. Selection of subcontractor will be determined at a future date.

1.2 RELATED WORK

A. Division 23, Mechanical

B. Division 26, Electrical

1.3 SUBMITTALS

A. Submit items of the Building Management and Control System (BMCS).
1. Temperature control equipment & Field devices.
2. Wiring & Flow diagrams.
3. Sequence of operation.
4. Complete, detailed, control and interlock-wiring diagram.
5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.
6. Submit Input / Output summary of all points.
7. Submit an outline of testing procedures from section Testing and Acceptance.
8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: “Comply, “Do Not Comply”, or “Not Applicable”. Explain all “Do Not Comply” statements.
9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

1.4 COOPERATION WITH OTHER TRADES

A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

1.5 WARRANTY

A. Provide with a manufacturer’s parts and labor warranty for a period of three years from substantial completion. Warranty period shall include graphic modifications and telephone support for troubleshooting and problem resolution.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Automated Logic Branch Office - WebCTRL

B. Climatec – Alerton Compass

C. Reliable by Unify Energy Solutions

2.2 SYSTEM ARCHITECTURE

A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.

B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways or central computers.

C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and

control connected equipment through its own microcomputer.

2.3 COMMUNICATIONS PROCESSING

A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.

B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be considered only if a similar device is provided as a stand-by. Upon a failure of malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.

C. The failure of any DDCP on the network shall not affect the operation of other DDCP's. All DDCP failure shall be annunciated at the specified alarm printers and terminals.

D. Network shall support a minimum communications speed of 115.2 Kbps.

E. The network shall support a minimum of 100 DDC controllers and PC workstations.

F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.

G. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

2.4 DDCP HARDWARE

A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.

B. Each DDCP shall incorporate a real-time clock.

C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.

D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:
1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
4. Digital outputs - to control two position devices such as starters, actuators, relays, etc.

E. Each DDCP shall be listed under UL916 (Energy Management Systems), and shall be tested to

comply with sub-part J of Part 15 FCC rules for Class A computing equipment.

F. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:
1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Dial-up communications
9. Manual override monitoring

G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.
1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2.5 PROGRAMMING FUNCTIONS

A. Resident software in each DDCP shall provide custom programming of control strategies.
1. Point database
2. Operator interface
3. Network communications
4. Facilities and energy management functions

B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral and derivative control.

C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English

language user interface. The OIP shall allow the user to program, interrogate, command and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

2.6 FACILITY MANAGEMENT SOFTWARE

A. The BMCS shall be provided with standard and custom report generation functions that include:
1. Alarm summaries
2. Motor status summaries
3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
4. Program listings

B. All reports shall be either displayed or printed by:
1. Operator request.
2. Time of day.
3. Event conditions (such as in response to an alarm, interlock, etc.).

C. All reports shall be time and date stamped.

D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.

E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.

F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.

G. A database and configuration report program shall be provided that allows the user to interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.

H. Any invalid operator entry shall result in an error message.

I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only, level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.

J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

2.7 ENERGY MANAGEMENT SOFTWARE

A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with

succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.

1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
3. A built-In "learning" technique shall cause the BMCS to automatically adjust itself to the most affective time to start equipment based on historical data.

B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off time. Appropriate time delays shall be provided to "stagger" on times.

1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.

C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:

1. Enthalpy optimization.
2. Supply air reset.
3. Hot water reset.
4. Chilled water reset.
5. Volumetric control.
6. Dead band control. Install dual set points as requested by user.
7. All specified energy management programs, whether or not applicable to this project shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.

2.8 WEB SERVER ACCESSIBILITY

A. Industry leading encryption technology to provide accessibility through a web browser.

B. Building Manager’s ability to access, view and command critical building information in real time over the intranet or internet.

1. Alarm Display
2. Point Commanding

3. Graphic Display
4. Scheduling
5. Running Reports
6. Point Details

2.9 REMOTE NOTIFICATION

A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
   1. Alphanumeric pagers
   2. Numeric pagers
   3. Email
   4. Phones via voice or short message service (SMS)

2.10 POINT EXPANSION MODULES

A. Capable of extending its input/output capabilities via special purpose modules.
   1. Modules may be mounted remote from the DDCP.
   2. Shall communicate with the DDCP over a pair of twisted cables.

2.11 TERMINAL EQUIPMENT CONTROLLERS

A. Provide for control of each piece of equipment, including, but not limited to, the following:
   1. Variable Air Volume (VAV) boxes
   2. Constant Air Volume (CAV) boxes
   3. Dual Duct Terminal Boxes
   4. Unit Conditioners
   5. Heat Pumps
   6. Unit Ventilators
   7. Room Pressurization
   8. Fan Coil Units

B. Include the following items:
   1. All input and outputs necessary to perform the specified control sequences.
      a. Analog outputs shall be industry standard signals such as 24V floating control.
   2. Sufficient memory to accommodate point database, operating programs, local alarming and local trending.
   3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
   4. Return to full normal operation without user intervention after a power outage of unlimited duration.
   5. Operation programs shall be field selectable for specific applications.
   6. Specific control strategy requirements, allowing for additional system flexibility.
   7. Controllers that require factory changes of all applications are not acceptable.

2.12 ELECTRONIC DAMPER ACTUATORS

A. Two position damper operators:
   1. Spring return to full travel position.
   2. Built in auxiliary switches (motor end switches)
      a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
   3. Minimum torque 60-in-lb

B. Modulating damper operators:
1. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure
2. Select the operator with available torque to exceed the maximum required operating torque by not less than 100%
3. Minimum torque 100 in-lb

2.13 ETHERNET CARD

A. Ethernet Card:
1. Local area network connection interface card.

2.14 CONTROL CABINETS

A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.
1. Powder coat painted on all sides
2. Cabinet with continuously piano type hinged door
3. Locking latch
4. All locks shall use a common key
5. Devices on the panel face must be identified with engraved nameplates.
6. Panels or termination panels must be identified with engraved nameplates.
7. Provide enamel beige finish and extruded aluminum alloy frame UL 50 certified.

2.15 AUTOMATIC CONTROL VALVES

A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.

B. Construction:
1. 2" and smaller:
a. Screwed.
b. Bodies and internal parts: Bronze, stainless steel or other approved corrosion-resistant metal.
2. 2-1/2" and larger:
a. Flanged.
b. Bodies: Cast iron or cast steel.
c. Seats and parts exposed to fluid: Bronze, stainless steel or other approved corrosion-resistant metal.
3. Characterized port ball valves are acceptable for VAV terminal units only.

C. Modulating straight through water valves: Equal percentage contoured throttling plugs.

D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.

E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.
1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
2. Maximum pressure drop: 5.5 psi.
3. Relief and bypass valves: Sized according to pressure available.
4. 2-position valves: Line size.
5. Manual by-pass operator.

F. Electronic Actuator:
1. Direct coupled installation
2. Visual and electronic stroke indicator
3. Die-cast aluminum housing

4. Manual override
5. Self-lubricating bearing and gear train
6. Automatic calibration
7. Automatic duty cycle protection
8. Overload and stall protection
9. Non-spring return
10. Floating /0-10 VAC / 4-20mA operation
11. UL approved
12. Provide smooth modulating action and tight close off against the system pressure.
13. Torque to exceed the maximum required operating torque by not less than 150%.
14. Actuator input signal shall be compatible with output DDC controller.
15. Provide weatherproof enclosure (exterior use).
16. Damper actuators not acceptable for valves.

G. Cooling Tower By-Pass and Chiller / Cooling Tower Isolation Valves & Actuators:
1. Valve Bray (Series 3L)
   a. Line Size Valve
   b. Under-cut disk for smooth operation
   c. Full Lug Valve
   d. Cast Iron Body
   e. EPDM – Molded-in Seat
   f. 416 Stainless Steel Stem
   g. Nylon Coated Ductile Iron Disc
   h. Disc-to-stem connection shall utilize a double “D” or key design requiring no screws or pins to connect stem to disc.
2. Electronic Actuator: Bray (Series 70)
   a. Fully configurable without need for software or handheld settings device
   b. Direct Mount
   c. Solid state speed control
   d. Visual and electronic stroke indicator.
   e. Anti-Condensation Heater (exterior actuators)
   f. Die-cast aluminum housing.
   g. Manual override by means of hand wheel
   h. Self-lubricating bearing and gear train.
   i. All steel self-locking output gearing to be provided
   j. Continuous Duty Rated Motor
   k. Overload and stall protection.
   l. Floating /0-10 VAC / 4-20mA operation.
   m. Mechanical Travel stops
   n. UL approved.
   o. Smooth modulating action.
   p. Tight close off against the system pressure.
   q. Sized to exceed 150% of the maximum required operating torque of the valve while under the maximum operating shut-off pressure
   r. Actuator input signal shall be compatible with output DDC controller.
   s. Provide weatherproof enclosure
   t. Damper actuators not acceptable for valves.

H. Variable Primary Flow By-Pass Control Valve:
1. Modulating straight through control valve with equal percentage contoured throttling plug and electronic operator.
2. Maximum pressure drop: 10 psi
3. Sized for minimum flow of one chiller
4. Torque to exceed the maximum required operating torque by not less than 150%.

2.16 FLOW DETECTION SWITCHES

A. Remote Flow Solid-State Flow Detection:
1. Extended length flow probe
2. Cabinet-mounted control monitor
3. Wetted parts, 316 stainless steel probe
4. Optional temperature and wire-break outputs
5. Flow and temperature switch points
6. LED bar graph display for status indication

B. Approved Manufacturer:
1. IFM Effector

2.17 DIFFERENTIAL PRESSURE SWITCHES

A. Wet/wet differential pressure switch
1. Integral Mounting Frame
2. Watertight, dust-tight, and corrosion resistant enclosure.
3. Wetted materials of brass and flouroelastomer.
4. Externally adjustable set point

B. Approved manufacturer:
1. Square D #9012GGW4
2. Dwyer #DXW-11-153-1
3. Carrier #HK06ZC033

2.18 TEMPERATURE LOW LIMIT SWITCH

A. Responsive to the coldest 1' section of its length.
1. Double pole single throw switch
2. 20' capillary
3. Line voltage with bellows actuated switch
4. Auto reset for outdoor installation
5. Manual reset for indoor installation

2.19 TEMPERATURE AND HUMIDITY SENSORS

A. Space Temperature Sensors
1. Thermister with resistance of 10,000 ohms at 77°F.
2. Accuracy shall be +/-1/2°F.
3. Range of 55° to 95° F.
4. Provide manufacturers calibration certificate.
5. Flush mounted
a. Stainless steel flush mount sensor, submit sample for review.
6. Location and height to be approved by Architect/Engineer prior to installation.
7. Provide guards impact resistant Polycarbonate equal to BAPI-Guard in the following locations:
a. Corridors
b. Cafeteria
c. Kitchen
d. Gymnasium
e. Dressing Rooms
f. Industrial Labs

B. Space / Duct Humidity Sensor

1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
2. Capacitance element shall be field replaceable and not require calibration.
3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
5. Provide impact resistant Polycarbonate equal to BAPI-Guard covers suitable for institutional use. Submit sample for review.
6. Provide manufacturers calibration certificate.
7. Provide impact resistant Polycarbonate equal to BAPI-Guard guards in the following locations:
   a. Corridors
   b. Cafeteria
   c. Kitchen.
   d. Gymnasium.
   e. Dressing Rooms.
   f. Industrial Labs.

C. Duct Temperature Sensors
1. Range of 20° to 120°F.
2. Single point sensing of temperature.
3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
4. Averaging elements of sufficient length to provide accurate, representative indication and control.
5. Averaging elements of sufficient length to prevent variances in temperature or stratification.

D. Liquid Immersion Temperature Sensors
1. Platinum type resistance temperature detector (RTD).
2. Match sensor range to medium being monitored.
   a. Hot water range 30° to 250°F.
   b. Chilled Water 20° to 70°F.
3. Furnish stainless steel wells for installation by Mechanical Contractor.
4. Locate all sensors in field with Owner/Engineer present.
5. System accuracy for liquid temperature sensing shall be +/-1/2°.
6. Sensors must be removable from wells.

E. Outside Air / Freezer / Cooler Sensors
1. Range of –58° to 122°F.
2. Weatherproof sun shield.
3. External trim material corrosion resistant with all parts assembled into water tight, vibration-proof, heat resistant assembly.
4. Minimum of 8' long leads.
5. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.

2.20 CURRENT SENSITIVE RELAYS

A. Ensure compatibility with VFD applications for variable speed motor status.
1. Provide with adjustable set point.
2. Relays must be mounted and not hung by power wires thru CT.
3. Provide split-core type current sensors.
4. Loop powered.
5. LED Status.
6. Acceptable Manufacturer: Veris Industries / Hawkeye
7. Relays shall close status contacts in response to current flow in power leads to the

equipment being monitored.

2.21 DIFFERENTIAL PRESSURE TRANSDUCER

A. Transducers to convert differential pressures to 4-20 MA analog outputs.
1. Solid state pressure sensor with accuracy of +/- 1% of calibration range.
2. Factory calibrated and have zero and span trimmers for field calibration.
3. Range shall be selected to match the medium being monitored.
4. Pressure snubbers to protect from pressure pulses and a 3-way bypass / valve assembly to protect the transducer from overpressure damage during start-up.
5. LCD Display
6. Acceptable Manufacturer: Rosemount 1151 or 3051 Pressure Transmitter

2.22 FLOW DIFFERENTIAL PRESSURE SWITCH

A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system differential pressure.
1. Select the pressure range based on the sensed differential pressure.
2. The unit shall be protected against overpressure to the full static pressure rating.
3. Accuracy: +/- 2% of full scale.

B. Switch assembly.
1. Reed switch.
2. NEMA-4 enclosure.
3. Threaded boss conduit entrance.
4. SPST action.
5. Voltage and rating as required for the control circuit.

C. Wetted parts shall be made of type 303 stainless steel.

D. Install an isolation valve in each sensing pipe leg to permit servicing without shutting the system down.

2.23 ELECTRIC REMOTE BULB THERMOSTAT

A. Two position remote bulb thermostat:
1. Bimetal controlled.
2. Sealed mercury switches.
3. Provide specified control action.
4. Adjustment can be made by removing unit cover.
5. Element with capillary length as required for the location.

2.24 ELECTRIC SPACE THERMOSTAT

A. Two position space thermostat.
1. Single Pole switch actuated by bi-metal sensing element.
2. Range shall be 60°F to 90°F.
3. Removable external knob adjustment means.

2.25 HIGH STATIC PRESSURE SWITCH

A. With manual reset switch
1. Approved manufacturer: Cleveland AFS-460.

2.26 INSERTION FLOW SENSORS

A. Turbine Flow Meter
1. Retractable hot tap flow sensor
2. Accuracy: +/- 1% of full scale
3. Dual Turbine
4. Custom thread-o-let 400 psi / 250°F rated
5. Line size from 2-1/2 to 72 inch
6. Metering range from 0.3 to 15 f/sec.
7. Remote NEMA 4 wall mounted LCD display
8. Field Pro Software & Communicator
9. Warranty two years
10. Approved Manufacturer: Onicon Flow Meter F1200 Series

B. Electromagnetic Flow Meter
1. Retractable hot tap flow sensor
2. Accuracy: +/- 1% of full scale
3. Electromagnetic
4. Custom thread-o-let 400 psi / 250 degree F rated.
5. Line size from 1-1/4 to 72 inch
6. Metering range from 0.3 to 15 f/sec.
7. Remote NEMA 4 wall mounted LCD display
8. Field Pro Software & Communicator
9. Warranty two years
10. Approved Manufacturer Onicon Flow Meter F3500

2.27 CONTROL DAMPERS

A. Opposed blade dampers.
1. Frames of 13-gauge galvanized sheet metal.
2. Provisions for duct mounting.
3. Damper blades not exceeding 8" in width.
4. Blades of two sheets of 16-gauge galvanized sheet metal.
5. Blades suitable for high velocity performance.
6. Bearings of nylon or oil-impregnated, sinthered bronze.
7. Shafts of 1/2" zinc-plated steel
8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
10. Submit leakage and flow characteristics data with shop drawings.
11. Linkage shall be concealed out of the air stream within damper frame.
12. Acceptable Model is Ruskin Model CD60.

2.28 PHOTO-CELL CONTROL

A. Light Sensitive Resistor.
1. 4-20 output or switch.
2. On = 3.0 / fc. Off 10.0 / fc.
3. UL Approved.

2.29 DRAIN PAN FLOAT SWITCH

A. Rated at 10 Amps.
1. Shuts off equipment if water level becomes too high.
2. DPDT Contacts.

2.30 BY-PASS AUTOMATIC SHUT-OFF TIMERS

A. Rated at 10 Amps, 125 VAC
   1. Shuts off equipment with timed switch
   2. White decorated timer
   3. Without hold feature
   4. Time Cycle 60 minutes

2.31 CO_2 SENSOR

A. Telaire Model T5100 CO_2/Temperature Sensor or approved equal
   1. Local visual indication of CO_2 levels in enclosed spaces.
   2. Pre-calibrated with factory default settings of 1000 ppm and 1500 ppm CO_2 levels
   3. Bright LED indicator transitions between green, yellow, and red as the CO_2 threshold is exceeded.
      a. Accuracy: +/- 30 ppm @ 72°F
      b. Output: 0-10 V (100Ω output impedance) and NTC 20k Thermister

2.32 AIR FLOW SENSING SWITCH

A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system positive, negative, or differential pressure.
   1. Select the pressure range based on the sensed differential pressure.
   2. The unit shall be protected against overpressure to the full static pressure rating.
   3. Accuracy: +/- 2% of full scale

B. Switch assembly:
   1. Reed switch
   2. Field adjustable setpoint
   3. Threaded boss conduit entrance
   4. SPST Action
   5. Voltage and rating as required for the control circuit

2.33 HVAC SHUTDOWN STATION

A. Lockdown Switch:
   1. Mushroom Yellow Button within a clear plastic cover
   2. Latches when depressed
   3. Twist reset
   4. Sign “HVAC SHUTDOWN”
   5. Manufactured by STI Model #SS2231HV-EN

2.34 AFTER HOURS A/C STATION

A. After Hours A/C Switch:
   1. Yellow Mushroom Button within a clear plastic cover
   2. Momentary contact configuration
   4. Sign “AFTER HOURS A/C”
   5. Manufactured by STI Model # SS2231HV-EN

2.35 PARKING LOT LIGHTS OVERIDE STATION

A. Override Button:
   1. Yellow Mushroom Button within a clear plastic cover
   2. Momentary contact configuration
   3. Sign “PARKING LOT LIGHTS”

4. Manufactured by STI Model # SS2234ZA-EN

PART 3 - EXECUTION

3.1 INSTALLATION

A. The control system shall be installed and final adjustments made by full-time employees of the factory-approved BMCS Building Management Control Subcontractor.

B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data in to the system.

C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore labor allowances should be made for such changes and adjustments if requested.

D. Points listed within this section are to be connected to the BMCS system as hard-wired points to cards and not connected through BacNet integration. The BacNet interface is for read only points not included within sequences of this specification.

3.2 INTERLOCK AND SAFETY CIRCUITS

A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
1. The damper and actuators are specified in this section.
2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
3. Provide motorized outside air dampers for the following:
   a. Supply fans
   b. AHUs
   c. Exhaust fans (except kitchen exhaust)

B. Close the chilled and hot water valves to the coil when the related unit is de-energized.

C. Interlock each chiller to start its dedicated chilled and condenser water pumps.
1. On shutdown provide a circuit to permit the chilled water pumps and condenser water pumps to run while the chillers pump down as required by the manufacturer.
2. As per manufacturer’s recommendations

D. Primary chilled water control:
1. Operating and safety controls are furnished as an integral part of the water-chilling unit and not specified in this section.
2. Provide a high limit temperature sensor in each primary chilled water pump loop.

E. Exhaust/Supply Fans:
1. Interlock the related exhaust and supply fans and the related outside air damper.
2. Interlock the exhaust fans with the related air-handling unit through software.
3. Interlock related exhaust fan for dishwasher with time delay off relay.
4. Interlock related exhaust fan for kiln with time delay off relay
5. Interlock kitchen hood related supply and exhaust fans.
6. Provide additional interlocks as indicated on fan schedule and on drawings.

7. Interlock electrical and mechanical room exhaust fans with thermostat.
8. Interlock refrigerant monitor with mechanical room purge system.
9. Interlock science room related supply and exhaust fans.
10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.

F. Cooling Tower Fan Safety Interlock: Provide interlock wiring for the vibration sensor, oil level switch and oil pump on each cooling tower fan.

G. Freeze Protection:
1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
   a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.
   b. Boilers - Enable during a freeze condition.
   c. Chillers – Open isolation valves then command by-pass valve to dump water into basin or by-pass tower. Enable condenser water pumps during a freeze condition.
   d. Air Cooled Chillers – Open isolation valves, then enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
   e. Protect coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, disable the DX cooling coil. If coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.
2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.

H. Drain Pan Float Protection:
1. Interlock to shut down unit and close valves.
2. Cooling Coils mounted above ceiling and in roof mounted units.
3. Provide for each cooling coil location.
4. Signal BMCS alarm point

I. Domestic Water System:
1. Interlock in-line circulating pumps at water heaters with return water pipe mounted thermostat to cycle pump with return water temperature.
2. Interlock high temperature entering water solenoid valve with thermostat on discharge side of tempered water mixing valves.

J. HVAC Shutdown Station:
1. Provide an emergency mushroom style push / pull station shutdown switch in the Administration Area or as directed by Owner / Architect.
2. Signal the building automation system to de-energize the HVAC equipment.
3. This is to stop exhaust fans and outside air units immediately.
4. Other air handling units, chillers and equipment shall be shut down in an orderly manner so as to not damage the equipment.

5. Once stopped, the system may only be restarted with a key operated switch located adjacent to the shutdown switch.

K. After Hours A/C Station:
1. Provide an momentary style push switch in the Principal's Office or as directed by Owner / Architect.
2. Signal the building automation system to energize the separate DX after hours unit serving the administration and associated sequence of operation.

L. Copper Tube Boiler:
1. Interlock each boiler to start its dedicated primary circulating pump. Interlock flow switch and pump to boiler safety terminal strip.
2. On startup enable boiler and primary pump prior to starting secondary system pump until primary loop temperature reaches 105 degrees as per manufacturer's recommendations.
3. Disable secondary pump if boiler goes into alarm or fails to produce heating water within 30 minutes.

M. Hydronic Heating Boiler:
1. Interlock each boiler to start its dedicated pump.
2. On startup enable boiler prior to starting primary pump. Boiler should reach operating temperature prior to starting system pump as per manufacturer's recommendations.
3. Disable system pump if boiler goes into alarm or fails to produce heating water within 30 minutes.

N. Condensing and Non-Condensing Hot Water Boilers:
1. Interlock each boiler to start its dedicated pump.
2. Install communication cable between each boiler and master controller specified by boiler manufacturer.

3.3 GRAPHICS

A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the complete Building Management Control System.
1. Modification of existing control systems shall be included.
2. These must be as-built and any changes during the warranty period drawings must be revised and updated.
3. Provide final sequence of operation in written format.

B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner.

C. Provide a color-coded floor plan of the building showing the location of each system, and the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.

D. Provide computer graphics for each system.

E. Provide final graphic room numbers as selected by District. Actual room names shall be used and not the architectural room numbers. Any graphic changes during the warranty period shall be included.

F. Graphics shall clearly display % open from 0-100% on all valves and dampers.

G. Graphics shall clearly display % run from 0-100% for all VFDs. Displaying current operating hertz only is not acceptable.

H. System shall include a graphical page that contains building and system related documents stored for ease of remote access.

I. Contractor shall schedule with district and engineer a graphics review 90 days prior to substantial completion.

3.4 IDENTIFICATION

A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.

B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.

3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

A. Furnish and install all wire, conduit, raceways and cable systems required for the complete operation of the Building Management and Control System.

B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:
1. Wiring of interlock system.
2. Wiring of control instruments.
3. Wiring of control panels.
4. Wiring of related power supplies, i.e. transformers.
5. Wiring of 120 VAC power circuits for control panels and devices.

C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.

D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.

E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.

F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other similar spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.

G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridle rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5’ centers and identified at each termination point and at 50’ centers minimum. Install wire parallel or perpendicular to the structural features of the building.

H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring

and shall not be installed in the same conduit with power wiring.

I. All wiring associated with building management and control system cover shall be as follows:
1. Sensor jacket color, Green
2. LAN communications, Yellow
3. All THHN wiring shall comply with Division 26 insulation color identification

3.6 EXHAUST AND SUPPLY FANS

A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.

B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.

C. Provide by-pass timers for fans indicated in Fan Schedule and in the following locations:
1. Fume Hoods
2. Science Room exhaust fans

POINT DESCRIPTION	TYPE	DEVICE
Start/stop	DO	Control Relay
Outside Air Damper	DO	Electronic Operator
Fan Status	DI	Current Sensitive Relay

3.7 BUILDING ELECTRICAL USAGE

A. Provide digital monitoring of the building KVA and KWH. Coordinate with the switchgear manufacturer.

B. Electrical Quality monitoring:
1. Monitor Watts, VA, VAR, Demand, Imbalance, and Power Factor.

3.8 MISCELLANEOUS

A. Freezer/Cooler Temperature Monitoring:
1. THE COOLER AND FREEZER MONITORING SHALL BE PROVIDED BY AUTOMATED LOGIC AND BE FULLY INTEGRATED INTO THE DISTRICT'S EXISTING AUTOMATED LOGIC SYSTEM UTILIZED FOR THIS PURPOSE.
2. Provide an analog temperature sensor located in the freezer compartment and cooler compartment.

POINT DESCRIPTION	TYPE	DEVICE
Freezer Temperature Alarm	AI	RTD
Cooler Temperature Alarm	AI	RTD

E. Interior Lighting Control:
Building Management Control System Scope
The lighting control system, as indicated on the electrical drawings lighting control details, will be provided with lighting control system BMCS interface devices via Lighting Control System Central

Hub, refer to Electrical Drawings and Details. The BMCS system shall send a occupied and unoccupied signal to the lighting control system BMCS interface device based on a BMCS schedule.

The BMCS provider shall provide an additional 8 hours of technician support to ensure the lighting control system is commissioned and operating as described.

Lighting Control System Scope
When the Lighting Control system BMCS interface devices in an area receives an occupied signal from BMCS, the lights in that area shall remain in their current state (typically off) but allow any local switch in that area to control the lighting in that space.

When the Lighting Control system receives an unoccupied signal from BMCS, the lighting control system shall flash the lights, and after a delay, the lights in that area shall be swept off by the lighting control system. In this unoccupied mode, the lighting control system shall allow any local light switch in that area to allow the lights to be controlled locally for 2-hours upon being switched on by the local switch. After the 2-hours, the lighting control system enable signal shall expire, and the lights shall again flash a warning, and if the local switch is not again activated, the lights shall be turned off by the lighting control system.

POINT DESCRIPTION	TYPE	DEVICE
Interior Lighting Control		DLM System Central Hub

F. Exterior Lighting Control
1. Provide individual time/photo-cell and time based control of each lighting contactor specified in Division 26.
   a. Provide separate control of each contactor.
2. The exterior lights shall be controlled by the BMCS using both a combination of photosensor, time schedules and astronomical sunrise/sunset. The exterior lights shall automatically come on when the sun sets based on the longitude and latitude coordinates of the facility (adjustable +/- 30 minutes). At 11 p.m. (adjustable) the time schedule shall turn off the exterior lights. At 4:00 a.m. (adjustable) the exterior lights shall automatically turn on based on time schedule. Upon sunrise, which shall be based on longitude / latitude of the facility the exterior lights shall turn off.
3. Between sunrise and sunset, photo-sensor shall only deactivate all exterior lighting when ambient light levels are above set point (adjustable).

POINT DESCRIPTION	TYPE	DEVICE
Lighting Contactor	DO	Control Relay
Momentary Control Switch	DI	Switch

D. Photocell: Provide a photocell mounted on the north side of the building. Location is to be approved by Owner / Architect / Engineer.

POINT DESCRIPTION	TYPE	DEVICE
Photocell	AI	Contact

E. Humidity Sensor: Provide a sensor in Library to monitor space conditions.

POINT DESCRIPTION	TYPE	DEVICE
Library Humidity	AI	Space Sensor

F. Outside Air: Provide a temperature sensor and a humidity sensor to monitor outside air conditions.

POINT DESCRIPTION	TYPE	DEVICE
Outside Temperature	AI	Thermistor
Outside Humidity	AI	Humidity Sensor

G. MDF/IDF Temperature: Provide a sensor in MDF and IDF rooms to monitor space temperature. BMCS shall send an alarm when the space temperature is 5 °F above the cooling set point. (Adjustable)

POINT DESCRIPTION	TYPE	DEVICE
MDF/IDF Temperature	AI	Space Thermistor

3.9 EXISTING AUTOMATION SYSTEM

A. The new system shall be fully integrated with the existing Building Automation System Host server located at the School District maintenance facility. If there is no existing manufacturer's host server a new server shall be included.

3.10 TERMINAL UNIT COORDINATION

A. Equipment furnished in this section and installed by Section 23 36 16:
1. Automatic temperature control card (DDC).
2. Damper Actuator

B. Equipment furnished and installed by Section 23 36 16:
1. Damper.
2. Multi-point flow sensor.
3. Power transformer.
4 Controller enclosure.

3.11 VARIABLE FREQUENCY DRIVE INTERFACE

A. Interface to the VFD directly

B. Interface may be hardwired or via RS-485

C. The following points shall be available at a minimum:

Point Name	Type
Start-stop	DO
Drive alarm	DI

Last fault	AI
Reset drive	DO
Percent output	AI
Frequency output	AI
Speed	AI
Current	AI
Power	AI
Drive temperature	AI
KWH	AI
Run time	AI

3.12 SINGLE ZONE AIR HANDLING UNITS WITH HUMIDITY CONTROL (AHU-4, AHU-9, AHU-10)

A. These units are furnished with a chilled water cooling coil and a hot water coil in the reheat coil position. Controls shall be as follows:
   1. A space temperature sensor shall, acting through the DDC panel, modulate the valves on the chilled water cooling coil and hot water reheat coil, in sequence, to maintain the desired space temperatures.
   2. A humidity sensor, located in the space, acting through the DDC panel, open the valve as required to maintain the scheduled leaving air temperature for maximum dehumidification.
      a. The space temperature sensor shall modulate the valve on the hot water reheat coil to maintain space temperature.
   3. The Space Humidity Sensor shall monitor the space relative humidity at all times. If the space relative humidity rises above the setpoint when the system is de-energized, over-ride the BMCS.
      a. Energize Air Handling Unit and Central Plant Equipment.
      b. Outside air damper shall remain closed and related exhaust fans de-energized.
   4. If an outside air unit provides the outside air for single-zone air handling unit, the outside air unit shall be activated during the occupied periods.
   5. Provide a CO2 sensor mounted as indicated on drawings.
   6. Variable frequency drive shall be used for soft start only.

POINT DESCRIPTION	TYPE S	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Space Temperature	AI	Space Thermistor
CHW Valve	AO	Electronic Operator
Space Humidity	AI	Humidity Sensor
HW Valve	AO	Electronic Operator
Return Air Temperature	AI	Temperature Sensor
CHW Coil Discharge Air Temp.	AI	Duct Thermistor

HW Coil Discharge Air Temp.	AI	Duct Thermistor
CO_2 Concentration	AI	CO_2 Monitor
Variable Speed Motor	AO	Motor Controller

3.13 SINGLE ZONE AIR HANDLING UNITS WITH HUMIDITY CONTROL (AHU-11)

A. These units are furnished with a chilled water cooling coil, a direct expansion cooling coil, a hot water coil in the reheat coil position and an electric duct heater.

B. Controls shall be as follows when central cooling and heating is available:
1. A space temperature sensor shall, acting through the DDC panel, modulate the valves on the chilled water cooling coil and hot water reheat coil, in sequence, to maintain the desired space temperatures.
2. A humidity sensor, located in the return air shall, acting through the DDC panel, open the valve 100% on the chilled water coil when above its setpoint for maximum dehumidification.
   a. The space temperature sensor shall modulate the valve on the hot water reheat coil to maintain space temperature.
3. The Space Humidity Sensor shall monitor the space relative humidity at all times. If the space relative humidity rises above the setpoint when the system is de-energized, over-ride the BMCS. (Selectable sequence)
   a. Energize Air Handling Unit and Central Plant Equipment.
   b. Outside air damper shall remain closed and related exhaust fans de-energized.
4. If an outside air unit provides the outside air for single-zone air handling unit, the outside air unit shall be activated during the occupied periods.
5. Variable frequency drive shall be used for soft start only.

C. Controls shall be as follows when central cooling and heating is unavailable:
1. A space temperature sensor shall, acting through the DDC panel, stage the condensing unit and electric duct reheat coil, in sequence, to maintain the desired space temperatures.
2. Variable frequency drive shall be used for soft start only.
3. Provide a temperature low limit switch located on the discharge side of the DX coil to de-energize the air handling unit and supply fan, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Space Temperature	AI	Space Thermistor
CHW Valve	AO	Electronic Operator
Space Humidity	AI	Humidity Sensor

HW Valve	AO	Electronic Operator
Condensing Unit	DO	Control Relay(s)
Electric Duct Heater	DO	Relay each stage
Return Air Temperature	AI	Temperature Sensor
Discharge Air Temperature	AI	Duct Thermistor
Variable Speed Motor	AO	Motor Controller

3.13 VARIABLE AIR VOLUME OUTSIDE AIR HANDLING UNIT WITH ENERGY RECOVERY SECTION (OAU-1/ERU-OAU-1, OAU-2/ERU-OAU-2, OAU-3/ERU-OAU-3)

A. Each unit shall consist of a supply air fan, exhaust air fan, a total energy recovery fixed plate heat exchanger, hot water coil and chilled water coil and ERV face and bypass damper. The supply fan and exhaust fan shall be started whenever the associated outside air unit fan is signaled to start.

B. BMCS shall enable unit operation and open outside air and exhaust air damper. Interlock ERU operation with the related air handling units.

C. The equipment graphics page shall display the instantaneous tonnage reduction displayed and provide trending of this point.

D. Variable air volume control:
1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
   a. Transmit a signal to the supply fan motor speed controller.
   b. Modulate the fan speed to maintain the desired static pressure.
   c. Coordinate signal with the fan motor speed controller.
3. Install a static pressure high limit safety device to de-energize the system.
   a. Manual reset.

E. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
1. Transmit a 4-20 MA signal to the supply fan motor speed controller.
2. Modulate the supply fan speed to maintain the desired static pressure. The exhaust fan shall maintain constant as the VFD is for soft start only.
3. Coordinate with the fan motor speed controller specified in another section.
4. Install a static pressure high limit safety device to de-energize the system.
   a. Manual reset.

F. The ERV face and bypass damper shall be modulated to open the bypass damper and close the face damper (linked damper for opposite action) at any point when the outside air temperature is below the leaving air temperature setpoint of the chilled water-cooling coil and above 40 degrees (adjustable). Bypass damper shall be used to prevent the need for cooling due to the heat recovered through the ERV in a winter condition.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Supply Fan Status	DI	Current Sensitive Relay
Exhaust Fan Status	DI	Current Sensitive Relay
Entering OA Temp	AI	Thermistor
Entering OA Humidity	AI	Relative humidity sensor
Leaving OA Temp	AI	Thermistor
Leaving OA Humidity	AI	Relative humidity sensor
Entering EA Temp	AI	Thermistor
Entering EA Humidity	AI	Relative humidity sensor
Leaving EA Temp	AI	Thermistor
Leaving EA Humidity	AI	Relative humidity sensor
Supply Fan Variable Speed Motor	AO	Motor Controller
Exh. Fan Variable Speed Motor	AO	Motor Controller
Differential Across Filters	DI	High / Low limit Switch
EA Dampers	DO	Control Relay
OA Dampers	DO	Control Relay
ERV Face Damper Damper	DO	Control Relay
ERV By-Pass Damper	DO	Control Relay
Static Pressure	AI	Static Pressure Sensor
CHW Valve	AO	Electronic Operator
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
Outside Air HW Valve	AO	Electronic Operator
High Static Limit	DI	High Static Limit Switch
Freeze Status	DI	Temperature Low Limit Switch

3.14 VARIABLE AIR VOLUME OUTSIDE AIR HANDLING UNIT (OAU-4)

A. Each unit shall consist of a supply air fan, hot water coil and chilled water coil.

B. BMCS shall enable unit operation and open outside air damper. Interlock OAU operation with the related air handling units.

C. Variable air volume control:
1. Duct static pressure sensor shall be located in the duct at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93.
2. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
   a. Transmit a signal to the supply fan motor speed controller.
   b. Modulate the fan speed to maintain the desired static pressure.
   c. Coordinate signal with the fan motor speed controller.
3. Install a static pressure high limit safety device to de-energize the system.
   a. Manual reset.

D. The static pressure sensors shall, through the DDC panel, accept the signal from the operating control sensor to:
1. Transmit a 4-20 MA signal to the supply fan motor speed controller.
2. Modulate the supply fan speed to maintain the desired static pressure. The exhaust fan shall maintain constant as the VFD is for soft start only.
3. Coordinate with the fan motor speed controller specified in another section.
4. Install a static pressure high limit safety device to de-energize the system.
   a. Manual reset.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
Supply Fan Status	DI	Current Sensitive Relay
Supply Fan Variable Speed Motor	AO	Motor Controller
Differential Across Filters	DI	High / Low limit Switch
OA Dampers	DO	Control Relay
Static Pressure	AI	Static Pressure Sensor
CHW Valve	AO	Electronic Operator
HW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
CHW Coil Leaving Air Temperature	AI	Averaging Duct Thermistor
HW Valve	AO	Electronic Operator
High Static Limit	DI	High Static Limit Switch
Freeze Status	DI	Temperature Low Limit Switch

3.15 OUTSIDE AIR VARIABLE VOLUME TERMINAL UNITS

A. Each unit shall consist of a pressure independent variable volume damper. The terminal unit's damper shall be interlocked with the associated AHU fan.
   1. The Controls Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position.
   2. A space CO2 sensor shall provide input to the central BMCS controller. The BMCS shall average all the CO2 levels of the zones served by the associated air handling unit and modulate the pretreated outside air damper to maintain set point (adjustable).

POINT DESCRIPTION	TYPES	DEVICE
Primary Air	AO	Variable Volume Damper Operator
Discharge Air Temperature	AI	Duct Thermistor

3.16 FAN COIL UNITS (CWFCU-1)

A. Each fan coil unit is furnished with a chilled water coil and hot water coil. Control shall be as follows:
   1. A space temperature sensor shall, acting through a terminal equipment controller, modulate the valves on the chilled water cooling coil and hot water reheat coil in sequence to maintain the desired space temperatures.
   2. Start/stop of fan coil unit shall be by terminal equipment controller.
   3. The outside air units providing the outside air shall be activated when the fan coil units are operating during the occupied periods.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
CHW Valve	AO	Electronic Operator
Space Temperature	AI	Space Thermistor
HW valve	AO	Electronic Operator
Discharge Air Temperature	AI	Duct Thermistor
Fan Status	DI	Current Sensitive Relay
Outside Air Damper	DO	Electronic Operator

3.17 VARIABLE VOLUME DUAL DUCT AIR HANDLING UNITS (AHU-1, AHU-2, AHU-5, AHU-6, AHU-7, AHU-8)

A. Units consist of a chilled water coil, a hot water coil, a fan, and a variable speed drive. Controls shall be as follows:
1. An electronic averaging duct sensor in the cold duct shall, acting through the DDC System, modulate the chilled water valve to maintain desired setpoint. An electronic averaging duct sensor in the hot deck shall, acting through the DDC system, modulate the hot water valve to maintain desired setpoint. A schedule shall be set up for the hot deck temperature based on outside air temperature. The temperature of the hot deck shall modulate between the following criteria. If the temperature outside is 50□F (adjustable) or below, the hot deck temperature shall be 95□F; if the outside temperature is 75□F or above, the hot deck coil shall be deactivated.
2. The unit shall be started and stopped from the BMCS system.
3. An electronic duct static pressure sensor shall be located in the cold and hot ducts at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93. The sensor shall transmit a signal to the supply fan motor speed controller, and modulate the fan speed to maintain a supply duct static pressure. A high limit static pressure sensor with manual reset, located at the fan discharge, shall de-energize the supply fan when sensing pressure above duct construction capabilities. Fan start-up shall be initiated at minimum air speed.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Hot Deck Temperature	AI	Temperature Sensor
Cold Deck Temperature	AI	Temperature Sensor
HW Valve	AO	Electronic Operator
CHW Valve	AO	Electronic Operator
Return Air Temperature	AI	Temperature Sensor
Duct Static Pressure (2)	AI	Static Pressure Sensor, One Each Deck
Fan Speed	AO	Motor Controller
Static Pressure High Limit (2)	DI	Static Pressure Switch, One Each Deck

3.18 VARIABLE VOLUME DUAL DUCT AIR HANDLING UNITS (AHU-3)

A. Units consist of a chilled water coil, a hot water coil, a fan, and a variable speed drive. Controls shall be as follows:
1. An electronic averaging duct sensor in the cold duct shall, acting through the DDC System, modulate the chilled water valve to maintain desired setpoint. An electronic averaging duct sensor in the hot deck shall, acting through the DDC system, modulate the hot water valve to maintain desired setpoint. A schedule shall be set up for the hot deck temperature based on outside air temperature. The temperature of the hot deck shall modulate between the following criteria. If the temperature outside is 50□F

(adjustable) or below, the hot deck temperature shall be 95 degF; if the outside temperature is 75□F or above, the hot deck coil shall be deactivated.

2. The unit shall be started and stopped from the BMCS system.
3. An electronic duct static pressure sensor shall be located in the cold and hot ducts at a position approximately 2/3 the distance from the fan in the longest duct run. Location is to be approved by Engineer and coordinated with Section 23 05 93. The sensor shall transmit a signal to the supply fan motor speed controller, and modulate the fan speed to maintain a supply duct static pressure. A high limit static pressure sensor with manual reset, located at the fan discharge, shall de-energize the supply fan when sensing pressure above duct construction capabilities. Fan start-up shall be initiated at minimum air speed.

B. After Hours DX A/C

1. Each unit is provided with an auxiliary DX coil and Air Cooled Condensing Unit with a variable capacity compressor. Control shall be as follows:
   a. This sequence shall only be permitted to operate when the central plant is deactivated.
   b. Upon activation of the AFTER HOURS A/C push button located in the principals office, the BMCS shall energize the air cooled condensing unit to stage and modulate to provide the leaving air temperature as scheduled. During the operation of the DX system, safeties shall be provided to restrict air handling units airflow from being reduced below the minimum required face velocity of DX coil per manufacturers recommendations. The terminal units airflow sum shall also be restricted from reducing below this set value.
   c. During After Hours operation the OAU shall not operate but instead the OA damper on the OAI shall open to provide OA. The electric duct heater shall be energized to maintain 40 °F OA leaving air temperature.
   d. During After Hour operation the Hot deck temperature shall be maintained by the electric duct heater in the hot duct.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Hot Deck Temperature	AI	Temperature Sensor
Cold Deck Temperature	AI	Temperature Sensor
HW Valve	AO	Electronic Operator
CHW Valve	AO	Electronic Operator
Condensing Unit	DO	Control Relay(s)
Return Air Temperature	AI	Temperature Sensor
Duct Static Pressure (2)	AI	Static Pressure Sensor, One Each Deck
Fan Speed	AO	Motor Controller
Static Pressure High Limit (2)	DI	Static Pressure Switch, One Each Deck

POINT DESCRIPTION	TYPES	DEVICE
Outside Air Damper	DO	Electronic Operator
OA Electric Duct Heater	DO	Relay each stage
Hot Deck Electric Duct Heater	DO	Relay each stage

3.19 DOUBLE DUCT VARIABLE VOLUME TERMINAL UNITS

A. Each unit shall consist of two pressure independent variable volume dampers, one on each duct inlet connection. Controls shall be as follows:
1. A space temperature sensor shall, through the direct digital control system, modulate the variable volume damper on the cold deck from full open to 40% air flow rate to maintain room setpoint. When heating is required, the temperature sensor shall first modulate the variable volume damper on the hot duct and cold deck while maintaining 40% airflow. If more heating is required, the temperature sensor shall modulate the variable volume damper on the hot deck from 40% to full open to maintain room setpoint.
2. The BMCS Contractor shall furnish the terminal box manufacturer with a controller to be factory mounted. The controller shall display cfm, temperature, and damper position.
3. The BMCS Contractor shall furnish the terminal box manufacturer the control flow diagram for correct mounting of flow measurement devices, wiring of actuators, and terminal equipment controllers.

B. Where Humidity Sensors are indicated on the drawings, provide a humidity control cycle for associate terminal. Control shall be as follows:
1. A space humidity sensor shall, through the direct digital control system when space humidity is above setpoint, modulate the variable volume damper on the cold deck to 75% air flow rate and modulate the hot deck damper to maintain room temperature setpoint. BMCS shall send an alarm when these spaces are above humidity setpoint for more that 15 minutes (adjustable)

POINT DESCRIPTION	TYPE	DEVICE
Space Temperature	AI	Space Thermistor
Primary Air (2)	AO	Variable Volume Damper Operator
CFM Flow (2)	AI	Control Panel
Discharge Air Temperature	AI	Duct Thermistor
Space Humidity	AI	Space Humidity Sensor

3.20 VARIABLE PRIMARY CHILLED WATER SYSTEM CONTROL

A. Chilled Water Central Plant consists of two air cooled chillers and two variable flow primary chilled water pumps. Each primary chilled water pump is sized for the maximum design flow rate of each chiller. Control shall be as follows:

1. On a call for cooling in the building the lead chiller's chilled water isolation valve shall open slowly. Travel time from fully closed to fully open shall be two minutes. The Indexed lead chilled water pump shall be energized and ramp up to full flow as required corresponding with the isolation valve travel. When internal chiller controls prove chilled water flow, lead chiller shall be energized. Chiller controls shall maintain leaving chilled water supply temperature set point of 42^{o}F (adjustable).
2. Two-system differential pressure sensors shall modulate the energized pump(s) speed controller to maintain the required system pressure in the building.
   a. Location of the building differential pressure system sensors shall be approved by the engineer and contractor specified in Section 23 05 93.
   b. Coordinate with the pump motor speed controller specified in another section.
3. On a daily basis change the chilled water pump lead/lag indexing. Daily lead pump indexed to run with the daily lead chiller, daily lag pump indexed to run with the daily lag chiller.
4. Measure the chilled water pressure drop across each chiller evaporator to monitor chiller minimum flow.
   a. Minimum flow as recommended by the chiller manufacturer.
   b. As the sensed differential pressure falls below the pressure drop associated with the chiller recommended minimum flow rate (3 psi, adj), modulate the variable primary flow by-pass control valve to maintain minimum flow through each chiller.
   c. Provide control valve and actuator capable of tight close-off against system differential pressure. Size the by-pass valve for the minimum flow of one chiller.
5. Upon a rise in common chilled water supply temperature to 45.5^{o}F (adjustable) for period of 15 minutes (adjustable), the lag chiller and related pump shall be energized.
   a. Prior to energizing, ramp the lead chilled water pump to 50% of flow (adjustable) and demand limit the lead chiller to 60% capacity (adjustable).
   b. Open lag chiller's chilled water isolation valve slowly with two minute travel time from fully closed to fully open and ramp up to 50% flow the indexed lag chilled water pump (adjustable). When internal chiller controls prove chilled water and condenser water flow, lag chiller shall be energized. Chiller controls shall maintain leaving chilled water set point of 42^{o}F (adjustable). Release constraints on chiller limits and chilled water pump speed controller to allow system to automatically meet the building requirements.
6. Upon a decreasing load condition, de-energize lag chiller in the opposite order that they were energized.
   a. Through an interface with the chiller controls, monitor percentage of running load amps (% RLA) of each chiller. When the total of both chiller % RLA drops to 90% (adjustable) of one chiller for 15 minutes (adjustable) de-energize the lag chiller. Allow lag chilled water pump to operate for 5 minutes (adjustable), then de-energize pump and close the chiller's chilled water isolation valve.
7. Alternate the lead/lag chiller on a daily basis.

POINT DESCRIPTION	TYPES	DEVICE
Chiller Start/Stop (Each chiller)	DO	Control Relay
Chiller Demand Limit (Each chiller)	AO	Chiller Control Module

POINT DESCRIPTION	TYPES	DEVICE
Chiller % RLA (Each chiller)	AI	Chiller Control Module
Chiller Isolation Valve (Each Chiller)	AO	Electronic Operator
Chilled Water Supply Temperature (Each chiller)	AI	Pipe RTD
Chilled Water Return Temperature (Each chiller)	AI	Pipe RTD
Chiller Differential Water Press. (Each chiller)	AI	Pressure Differential Sensor
Pump Start / Stop (Each of two pumps)	DO	Control Relay
Pump VFD (Each of two pumps)	AO	Motor Controller
Pump Status (Each of three pumps)	DI	Current Sensitive Relay
Chilled Water System Bypass Valve	AO	Electronic Operator
Building Common Supply Water Temperature	AI	Pipe RTD
Building Common Return Water Temperature	AI	Pipe RTD
Building Flow	AI	Turbine Flow Meter
Building Pressure Differential (Two required)	AI	Pressure Sensor

3.21 HYDRONIC HOT WATER HEATING SYSTEM

A. This system consists of two condensing hot water boilers with constant flow primary boiler pumps and variable flow hot water secondary pumps. Control of the hydronic hot water heating system is as follows:

1. Energize the hydronic hot water heating system whenever there is a call for heating in the building.
   a. Monitor all control valves to determine if a heating requirement exists.
2. Energize the hybrid sequence controller specified elsewhere.
   a. The hybrid sequence controller shall control all functions and sequencing of the hot water heating boilers.
   b. Connect all boilers to the master boiler controller specified elsewhere with communication cable as required.
3. Hydronic hot water heating system supply temperature reset.
   a. A temperature sensor sensing outdoor temperature shall provide an input to the hybrid sequence controller to reset the hot water supply temperature.
      1) Maintain 130°F supply water temperature whenever the ambient temperature is 20°F and below.
      2) Maintain 110°F supply water temperature whenever the ambient temperature is 60°F and above.
      3) All reset temperatures shall be adjustable through the BMCS.
4. Secondary hot water pump control:

a. A system differential pressure sensor shall modulate the hot water pump variable frequency drives and stage pumps A and B to maintain system differential pressure.
b. This system shall be completely adjustable in the field.

POINT DESCRIPTION	TYPES	DEVICE
Hybrid Sequence Controller	DO	Control Relay
Boiler Alarm Status	DI	Safety Relay (Each Boiler)
Secondary Hot Water Pump Start/Stop/Modulation	AO	Variable Frequency Drive (Each Pump)
Pump Status	DI	Current Sensitive Relay
Building Hot Water Supply/Return Temperature	AI	Pipe RTD
Boiler Discharge Water Temperature	AI	Pipe RTD (Each Boiler)
Ambient Temperature	AI	Thermistor
Boiler Supply Water Reset	AO	Hybrid Sequence Controller

3.22 DISHWASHER EXHAUST

A. Interlock exhaust fan to operate when dishwasher is operating. Provide 5 minute (adjustable) run time for fan after dishwasher stops.

3.23 START-UP AND POINT VERIFICATION

A. Final startup and point verification shall include the following information.
1. Field panel checkout:
a. Verify enclosure is not mounted on vibrating surface.
b. Verify class I and class II wiring is separated within enclosure.
c. Check for shorts/grounds/induced voltages/proper voltages.
d. Verify proper point terminations in accordance with as-builts.
e. Verify that all modules are in proper place and addressed.
f. Verify proper power voltage.
g. Load database and programming.
h. Startup the panel.
i. Point and device checkout.
2. Analog input point checkout:
a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.
c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value

(COV) limit has been defined.

d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.

e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.

f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.

3. Digital input point checkout:

a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.

b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.

c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).

d. Set-up and/or calibrate the associated equipment, i.e. smoke detector, high/low temp detector, high/low static switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.

e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).

4. Digital output point checkout:

a. Verify that device is correctly wired and terminated as shown in the design documentation package.

b. Verify that the correct voltage is utilized in the circuit.

c. Verify the point database to be correct (i.e. point name, address, etc.).

d. Check and verify that the end device responds appropriately to the digital output(s).

e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.

f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.

g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.

5. Analog output point checkout:

a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.

b. Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply,

etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.

c. Verify the point database to be correct. Verify that the correct COV limit has been defined.

d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.

e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.

f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.

g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, host console devices, etc. can also command these outputs.

h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.

6. Terminal equipment controller checkout:
   a. Load program database
   b. Enable programs
   c. Verify sequence of operations

7. Programming checkout:
   a. Provide checkout for each system and sequence of operation.
   b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy, and may be modified to meet your specific requirements.
   c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
   d. Input to Trigger Test: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10°F).
   e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.
   f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.

8. Workstation checkout:
   a. Verify the operation of all trunk interface equipment.
   b. Verify all workstation software, including options, based upon the installation instructions for the PC.
   c. Perform software backup (site, options, etc.)
   d. Complete workstation configuration report for owner signoff.

e. Provide verification that all graphics have been created, as required by project bid documents.

3.24 TESTING AND ACCEPTANCE

A. General:
1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.
   a. Follow in the order specified.
   b. Each testing phase shall be satisfactorily completed before entering the next phase.
2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test or demonstration.
3. Submit for approval, a sample of the form on which the test will be reported.
   a. Identify project.
   b. Provide a list of all points, arrange in numerical order of point addresses.
      1) Show point descriptor and location of each.
      2) Indicate DDC panel that processes each point.
      3) Use the list as a basis for the specified report form.
   c. Signatures of participants and observers.
   d. Results.
   e. Description of adjustment or corrections of points in error.
   f. Date.
4. Provide schedule of tests. Estimate dates of significant events.
5. Test, calibrate and adjust each point in the system as specified.
6. Provide documentation of all tests and verifications as specified.
7. Provide trend reports indicating proper control of all points for an extended period of time.

B. Phase 1 - Testing, Calibrating, and Adjusting:
1. Operate each analog point in the entire system.
   a. At a point in the upper quarter of its range.
   b. At a point in the lower quarter of its range.
   c. At its operating point.
2. Provide personnel and diagnostic instruments at both the central and remote locations.
3. Provide testing stimulants for alarms.
4. Use digital meters of double the accuracy of the instruments being calibrated.
5. Provide an approved test device for simulating high and low temperatures.
6. When the function is performed, read values at the central control and observe the actual function at the field instrument.
7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
9. Test all power transducers with a Dranetz Power Analyzer.

C. Phase 2 - Equipment and Point Verification:
1. Verify calibration or function of each point.
   a. Verify analog points at operating value.
   b. Record on specified form.
   c. Make approved adjustments to out of tolerance points.
      1) Identify these points for ready reference.
2. After verification procedure in completed:
   a. Verify corrected points.
   b. Record on specified form.

c. Points requiring correction.
1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.

D. Phase 3 - Software Verification:
1. Submit agenda and report format for software demonstrations.
2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
3. Demonstrate compliance with response time specifications.
a. Simulate normal heavy load conditions.
b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
4. Demonstrate DDC loop response. Supply graphical trend data showing each DDC loop's response to a setpoint change representing an actuator position change of at least 25% of full range. Trend sampling rate shall be from 10 seconds to 3 minutes, depending on loop speed. Each sample's trend data shall show setpoint, actuator position and controlled variable values. Addition tuning of each loop that displays unreasonable under or over damped control.
5. Demonstrate demand limiting. Supply trend data output showing demand-limiting algorithm action. Trend data shall document action sampled each minute over at least a 30 minute period and shall show building KW, demand limiting setpoint, status of setpoints and other affected equipment parameters.
6. Demonstrate trend logs for each system. Trend data shall indicate setpoints, operating points, valve positions and other data as specified in the points list provided with each sequence of operation.
7. Demonstrate full lighting controls interface interlocks with other building systems.
8. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.

E. Provide the following reports to Engineer at final completion of all Testing:
1. List of all points.
2. List of all points currently in alarm.
3. List of all disabled points.
4. List of all points in over-ride status.
5. List of all points currently locked out.
6. List of user accounts and access levels.
7. List all weekly schedules.
8. List of holiday programming schedules.
9. List of limits and deadbands.
10. System diagnostics reports including, list of DDC panels on line and communicating, status of all DDC terminal units device points.
11. List of programs.
12. Provide trend data reports to ensure proper operation and sequence control of BMCS.

F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.25 TRAINING

A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

B. Provide 4 hours of training for Owner's designated operating personnel. Training shall include:

Explanation of drawings, operations and maintenance manuals
Walk-through of the job to locate control components
Operator workstation and peripherals
DDC controller and ASC operation/function
Operator control functions including graphic generation and field panel programming
Operation of portable operator's terminal
Explanation of adjustment, calibration and replacement procedures
Student binder with training modules

C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.26 PROJECT MANAGEMENT

A. Provide a designated project manager who will be responsible for the following:
1. Construct and maintain project schedule.
2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
3. Attend project meetings as necessary to avoid conflict and delays.
4. Make necessary field decisions relating to this section.
5. Coordination / Single point contact.
6. Have Internet access for project management.

END OF SECTION 23 09 33

SECTION 23 09 34 COORDINATION OF BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The items listed below shall be furnished and/or installed by this contractor.

PART 2 - PRODUCTS

A. Products provided by the Building Management and Control System (BMCS) Contractor.
   1. Control Valves
   2. Dampers
   3. Wells for sensors installed in piping system
   4. Flow Meters

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate with the Building Management and Control System (BMCS) Contractor.
   1. Provide project-scheduling information to the BMCS Contractor to allow ample time for purchase of equipment and devices.
   2. Schedule periodic project meetings to review progress and coordination issues.
   3. Submit a written report, to the Architect/Engineer, on a monthly basis stating status of coordination effort.

B. The BMCS contractor will submit shop drawings to this contractor for review and coordination processing.

3.2 INSTALLATION

A. This Contractor will be responsible for the following:
   1. Installation of control valves for HVAC equipment.
   2. Installation of dampers for HVAC equipment.
   3. Installation of temperature sensor wells in piping.
   4. Installation of pressure taps in piping system.
   5. Installation of flow meter taps in piping system.

B. Install the above material under the direction of the Building Management and Control System (BMCS) Contractor.

END OF SECTION 23 09 34

SECTION 23 20 00 HVAC PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.2 RELATED WORK

A. Division 23 Mechanical:
1. Earthwork.
2. Valves, Strainers and Vents.
3. Vibration Isolation.
4. Insulation.
5. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.

B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.

C. Solder joints.
1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.

D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.

E. Flanged.
1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.

2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.
6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

2.3 UNIONS

A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

2.4 BRANCH CONNECTIONS

A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.

B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

2.5 GASKETS

A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.

B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

2.6 FLOORS AND CEILING PLATES

A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe

or insulation and lock in place.

2.7 DOMESTIC MANUFACTURE

A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

PART 3 - EXECUTION

3.1 PIPE FABRICATION AND INSTALLATION

A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufactured, for maintenance.

B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.

D. Install piping without tapping out of the bottom of pipe.

3.2 WELD

A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.

B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.

C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.

D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.

E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.

F. Bevel ends of ferrous pipe.

3.3 OFFSETS AND FITTINGS

A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and

offsets and fittings.

3.4 SECURING AND SUPPORTING

A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.

B. Provide supports both sides and within 12” of each horizontal elbow for pipe 6" and larger.

C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.

D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.

E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2” minimum vertical adjustment.

F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.

G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.

H. Provide hangers within 3' of pipe length from all coil connections.

I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

3.5 PIPE SUPPORTS

A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.

B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.

C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

3.6 PIPE SUPPORTS ON ROOF

A. Support condensate drain pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

3.7 ANCHORS

A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

A. Sleeves through masonry and concrete construction:
1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.

B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16 gauge galvanized sheet metal.

C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.

D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2” above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.

E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.

F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron

pressure plate.

G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.

H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate. Flush the chilled and hot water systems utilizing the filter feeders.

B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.

C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until “potable water clear” and particles larger than 5 microns are removed.

D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.

E. Dispose of water in approved manner.

F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be equal to Nalco 2578 prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacture. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.

G. Phase Three: Final flushing and rinsing: Flush and rinse until “potable water clear” and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.

H. Submit status reports upon completion of each phase of work on each system.

I. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.

J. Contractor shall coordinate scheduling with district so owner or owners representative and architect and Engineer can observe cleaning of piping systems at each phase listed above.

3.13 TESTING

A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.

B. Do not insulate or conceal piping systems until tests are satisfactorily complete.

C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.

D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

3.14 PIPE MARKERS

A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

C. Install identification in the following locations:
1. both sides of penetrations through walls, floors and ceilings.
2. Close to valves or flanges.
3. Intervals on straight pipe runs not to exceed 50 feet
4. Apply marker where view is obstructed.

D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 “Scheme for Identification of Piping Systems”.

END OF SECTION 23 20 00

SECTION 23 21 13 HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install heating water and chilled water piping, valves and appurtenances, including fittings and strainers. Domestic hot water piping is specified in the Domestic Water Piping and Appurtenances section.

1.2 RELATED WORK

A. Division 23 Mechanical:
1. Pipe and Pipe Fittings - General
2. Valves, Strainers and Vents
3. Vibration Isolation
4. Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. For pipe 2" and less in diameter, provide pipe conforming to ASTM A 53, Grade A or B, or ASTM A106 standard weight seamless, or electric-resistance welded black steel pipe. Furnish 150 lb. screwed malleable iron fittings conforming to ANSI B 16.3 for chilled water. Provide fittings conforming to ANSI B 16.4 for hot water.

B. For pipe 2-1/2" in diameter and larger, provide pipe meeting the requirements of ASTM A 53, Grade A or B, or ASTM A 106 standard weight seamless, or electric-resistance welded black steel pipe with standard weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

2.2 VALVES

A. Refer to Section 23 05 23.

B. Refer to Building Management and Control System.

2.3 WATER SPECIALTIES

A. Pressurized Expansion Tanks shall be precharged steel tank with a replaceable heavy duty Butyl rubber bladder. The tank shall have a 1-1/2" system connection, drain, and a standard tire valve to facilitate on-site charging of the tank. The tank shall be fitted with lifting rings and a floor mounting skirt for vertical installation. The tank must be constructed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and stamped 125 PSI working pressure.
1. Acceptable manufacturers: Bell & Gossett, Taco, Wessels, John Wood Company, and Wheatley.

B. Air and Dirt Separators shall be a full flow coalescing type combination air eliminator and dirt separator. The separator shall be designed for full flow high volume systems. The inlet and outlet connections shall be the same as adjoining pipe. Vessel shall be fabricated steel, rated for 150 psig working pressure, stamped and registered in accordance with ASME Section VIII, Division 1 for unfired pressure vessels, and include two equal chambers above and below the inlet and outlet nozzles. The vessel shall include copper or stainless steel coalescing medium to aid in the separation of air and dirt in the system entrained water. Air elimination efficiency shall be 100% free air, 100%

entrained air, and a minimum of 99.6% dissolved air at the installed location. Dirt separation efficiency shall be a minimum of 80% of all particles 30 micron and larger within 100 passes. Unit shall be provided with a separate venting chamber to prevent system contaminants from harming the float and venting valve operation.

1. Acceptable manufacturer shall be Spirovent Series HV by Spirotherm, TACO High Velocity 4900 or Thrush High Velocity

C. Automatic Air vents shall be float actuated high capacity air vent designed to purge free air from the system and provide shutoff at pressures up to 150 psig at a maximum temperature of 250 degrees F. The design of the high capacity air vent shall prevent air from entering the system if system pressure should drop below atmospheric pressure. The high capacity air vent shall purge free air at pressures up to 150 psig during normal system operation. The high capacity air vent shall be constructed of cast iron and fitted with components of stainless steel, brass, and EPDM.

1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.

D. Pressure Reducing Valves shall be diaphragm operated with brass body, low inlet pressure check valve and inlet strainer. The strainer shall be easily removed without system shutdown. The valve seat, strainer, and stem must be removable and of non-corrosive material.

1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.

PART 3 - EXECUTION

3.1 TESTING

A. Test all piping systems to assure they are absolutely leak free.

B. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150 psig minimum, and check for leaks. Maintain test for a minimum of 24 hours. The piping system must remain absolutely tight during this period. The satisfactory completion of any test or series of tests will not relieve the contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories. The test should be observed by the Architect / Engineer before pressure is removed and water drained.

3.2 AIR HANDLING UNIT PIPING

A. Provide a minimum of 12" of straight pipe at all coil piping connections.

3.3 AIR/DIRT SEPARATOR

A. Install full size drain to nearest floor drain.

END OF SECTION 23 21 13

SECTION 23 21 23 HVAC PUMPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General characteristics for pumps specified in Division 23 - Mechanical.

1.2 RELATED WORK

Requirements for pumps are specified in other sections of Division 23 - Mechanical, including the following:

A. Division 23 Mechanical - Electrical Provisions of Mechanical Work.

1.3 PUMP SELECTION

A. Select pumps conservatively for scheduled conditions. Furnish pumps that have reasonably high efficiencies, with peak efficiency at or near rated conditions. Select pumps that will operate stably at 15' suction lift despite substantial reduction in head or substantial increase in delivery.

B. If the pumps proposed are not considered suitable, submit manufacturer's data on other pumps, for review.

C. Scheduled design flow, design head, pump efficiency, and motor horsepower are the minimum acceptable.

D. The pump curve shall rise continuously from maximum flow to cut-off.

E. Shut-off head approximately 10 percent greater than design head, unless otherwise indicated in pump schedules.

F. Pump brake horsepower shall not exceed the motor horsepower rating over the entire operating range from shut-off to run-out.

G. Select the pump for operation at or near peak efficiency.

H. Cavitation-free at all points on the curve.

I. Impeller diameter shall not exceed 90 percent of the maximum published diameter.

J. Pumps shall be suitable for parallel operation. Where pumps are operated in parallel, individual pumps shall be capable of stable operation with only one pump operating in the system. Submit pump curves with single and multiple pumps operating on system curve for approval.

1.4 PUMP SIZE AND TYPE

A. Provide motor-driven pumps of the type and speed scheduled. Select pumps that are not overloaded throughout the entire range of pump operation. Provide pump connection sizes as indicated.

B. The head capacities indicated in the schedules are listed for bidding purposes only.

Calculate the operating head at each pump; take into consideration the actual routing of the various lines, pressure drops in heat exchangers and coils, exact lengths of pipe, fittings, etc. Submit these calculations, together with copies of manufacturer's performance curves, as shop drawings on each pump. Clearly mark the curves for each pump to indicate the diameter of the impeller and the selection point.

1.5 CERTIFIED DATA

A. Submit factory certified pump curves showing pump performance characteristics with pump and system operating points plotted. Curves shall include as a minimum, flow (gallons per minute), head (feet of water), all available impeller diameters (inches), efficiency (percent), net positive suction head required (feet of water), brake horsepower, pump size and pump model. When multiple pumps are operating in parallel, show pump curves for one pump running, two pumps running, and so on. Show pump curves with system curve plotted.

PART 2 - PRODUCTS

2.1 VERTICAL IN-LINE (VIL) PUMPS

A. Pump Construction:
1. Pump casing, cast iron with 125 psig ANSI/PN16 flanges for working pressure below 175 psig at 150°F and ductile iron with 250 psig ANSI / PN25 flanges for working pressure to 375 psig at 150°F.
2. Suction and discharge connections shall be flanged and the same size and shall be drilled and tapped for seal flush and gauge connections.
3. Impeller: Bronze, fully enclosed type; dynamically balanced, two-plan balancing is required where installed impeller diameter is less than 6 times the impeller width.
4. Shaft: Provide stainless steel pump shaft.
5. Coupling: Rigid spacer type of high tensile aluminum alloy. Coupling is to be designed to be easily removed on site to reveal a space between the pump and motor shafts sufficient to remove all mechanical seal components for servicing and to be replaced without disturbing the pump or motor.
6. Mechanical seals shall be stainless steel multi-spring inside or outside balanced type with Viton secondary seal, carbon rotating face and silicon carbide stationary seat. Provide 316 stainless steel glad plate. Provide factory installed flush line with manual vent.
7. Split coupled pumps shall be provided with a lower seal chamber throttle bushing to ensure seals maintain positive cooling and lubrication.
8. Provide seal flush supply line to the mechanical seal with a 50 micron cartridge filter and sight flow indicator to suit the working pressure encountered. Filters shall be changed by the installing contractor after system is flushed and on a regular basis until turned over to the Owner.
9. Supply in the flush line to the mechanical seal a maintenance free sediment separator with sight flow indicator.

B. Single stage, single or double suction type, with pump characteristics which provide rising heads to shut off. Refer to pump schedule for pump flows and heads and motor speed, enclosure, efficiency and power requirements and other system conditions.

C. Pump Motor:
1. Premium efficiency
2. Totally enclosed fan cooled
3. Cast iron frame and end plate

4. Forge steel lifting eye
5. Over sized conduit box with ground lug
6. So sized with relation to the pump impeller that the brake horsepower requirements will not overload the motor at any point on the pump curve
7. Designed for Variable Frequency Drive Application
8. Minimum Efficiency

3 hp	1800 rpm	89.5%
5 hp	1800 rpm	90.2%
7.5 hp	1800 rpm	91.7%
10 hp	1800 rpm	91.7%
15 hp	1800 rpm	92.4%
20 hp	1800 rpm	93%
25 hp	1800 rpm	93.6%
30 hp	1800 rpm	94.1%
40 hp	1800 rpm	94.5%
50 hp	1800 rpm	94.5%
60 hp	1800 rpm	95%
75 hp+	1800 rpm	95.4%

D. Data plates:
1. Provide the pump with a nameplate constructed of 300 series stainless steel securely fastened to pump casing with stainless steel pins.
2. Locate the nameplate for easy visibility.
3. Clearly stamp the rating conditions and other data below, as a minimum, on the nameplate.
   a. Manufacturer, address, telephone number
   b. Pump model number
   c. Pump serial number
   d. Size (including impeller diameter scheduled in inches)
   e. Type
   f. Equipment designation as listed on the pump schedule.
   g. Flow scheduled (gallons per minute)
   h. Dynamic head scheduled (feet of water)
   i. Efficiency (percent)
   j. Shut-off head (feet of water)
   k. Speed (rpm)
   l. Brake horsepower
   m. Maximum brake horsepower with rated impeller
   n. Rotation
   o. Maximum allowable pressure (psig)

E. The schedule on the drawing sets forth the type of pump and GPM required.
1. The head capacities and horsepower are for bidding purposes only.
2. Make pump selection based on actual system calculations.

F. Acceptable manufacturers:
1. Armstrong Series 4300
2. Aurora
3. Bell & Gossett

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the pumps in accordance with Manufacturer's "Installation, Start-up and Service Instructions".
   1. Provide access space around pumps for service.
   2. Install pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Install stainless steel drain pan with trough under chilled water pumps only.
   3. Provide air cock and drain connection piped to floor drain.
   4. Lubricate pumps prior to start-up.
   5. Install condenser water pumps to ensure a full flooded suction.
   6. Paint entire unit with two coats of machinery enamel after completion of installation.
   7. Provide a spool piece between the suction diffuser and the suction side of the pump minimum length 8" face to face.
   8. Provide pressure taps with valves on each side of the pump.
   9. Install hot water circulator horizontally, properly supported to wall, in an accessible location for testing and maintenance at a height not to exceed 60” above finished floor. Install line size Ernst bronze rotating wheel, flow indicator with double window, downstream of circulator.

B. Provide a line size isolation valve and strainer on the pump suction and a line size silent check valve and balancing valve on the pump discharge. Provide an automatic air vent off the pump casing. For base mounted pumps, provide a drain line the full size of the base connection and extend it to and terminate it over the nearest floor drain.

C. Support piping adjacent to the pump such that no weight is carried on the pump casing. Decrease from pipe size with eccentric reducer on suction side and concentric increaser on discharge side.

D. Ensure pumps:
   1. Operate at specified system fluid temperatures without vapor binding and cavitation.
   2. Are non-overloading in parallel and individual operation.
   3. Operate within 25 percent of midpoint of published maximum efficiency curve.

E. Refer to pump detail on the Contract Drawings for piping accessories to be provided.

3.2 MANUFACTURER START-UP SERVICE ALIGNMENT

A. After installation, the pumps and motors are to be aligned by the manufacturer or their representative utilizing a dial indicator. After completion, a formal report must be submitted by the Manufacturer to the Engineer prior to final acceptance. This report must include pump serial number, location, beginning and final alignment at a minimum.
   1. Technicians, as required, shall be trained and experienced in the work they perform (contractor start-up / alignment is unacceptable).

B. Before starting pumps, but after connecting piping:
   1. Align shafts and coupling with a precision dial indicator alignment instrument to the minimum tolerances .004 (TIR) per inch of coupling radius or as recommended by the manufacturer, whichever is the greater.
   2. Tabulate the actual pump alignment reading with manufacturer's minimum tolerances.
   3. Submit readings for approval.
   4. Include the approved readings in the Owner's Maintenance Manual.

3.3 FINAL PUMP FLOW CALIBRATION

A. Based on the results of the final phases of the test and balance sequences, if the flow of the unthrottled pump is more than 10% above the scheduled values:
   1. Request detailed instructions from the pump manufacturer for the correct impeller diameter.
   2. Trim the impeller to the diameter recommended by the manufacturer, employing precision machinery.

B. Enter the information on the final configuration of the pump in the Owner's Manual.
   1. Modify the pump nameplate to reflect the correct head and flow data and the impeller diameter.

3.4 SPARE PARTS

A. Provide the following spare parts and material to the Owner for his use after the warranty period.
   1. A mechanical seal for each pump
   2. A set of bearings for each pump

END OF SECTION 23 21 23

SECTION 23 23 00 REFRIGERANT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install copper tubing, valves, strainers and sight glass for refrigerant piping.

1.2 RELATED WORK

A. Division 23 Mechanical.
1. Pipe and Pipe Fittings
2. Piping Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Furnish refrigerant piping of Type K hard-drawn copper tubing with sweat-type, wrought copper fittings. Cast fittings are not permitted.

2.2 SERVICE VALVES

A. Provide angle or globe service valves, with sweat connections. Use packed-type, wrench operated, valves with gasketed seal cap and back seat feature. Furnish valves designed for refrigerant service, in conformance with the ARI code.

B. Place service valves at the inlet and outlet of each compressor, on both sides of each strainer and solenoid valve, and as otherwise shown and specified.

2.3 SOLENOID VALVES

A. Furnish pilot-operated, floating-piston solenoid valves suitable for operation with refrigerant.

B. Use valves with a bronze body and sweat-type connections.

C. Provide stainless steel stem and plunger assembly and a stainless steel piston.

D. Furnish sealed and moisture proof solenoid coils.

E. Use electrical characteristics of 115 volt, 60 Hertz.

2.4 SIGHT GLASSES

A. Provide suitable moisture and liquid sight glass in the liquid line leaving the condenser or receiver.

2.5 FILTER DRYER

A. Furnish replaceable core liquid line filter dryer.

B. Provide filter dryer constructed to permit the removal of the core element without removing the filter dryer from the line.

PART 3 - EXECUTION

3.1 BRAZING

A. During the brazing process, dry nitrogen shall be purged through the tubing to prevent oxides from forming.

3.2 PRESSURE TEST

A. After refrigeration and piping system items are installed, charge the system with dry nitrogen and test to 450 psig.
   1. Test joints with a Halide torch or an electronic leak detector.
   2. Repair leaks and retest each system until proved tight.

B. Refrigerant piping systems shall be pressure tested for strength and leak tested for tightness in accordance with the requirements of section 1110 Refrigeration Piping System Test in Chapter 11 of the 2021 International Mechanical Code after installation and before being placed in operation. Tests shall include both high and low pressure sides of each system.

3.3 EVACUATION AND DRYING

A. After refrigerant system has been pressure-tested, connect a suitable vacuum pump and evacuate piping system, including lines and equipment.
   1. Maintain a vacuum as high as practicable for long enough to evaporate the moisture in the system (at least 48 hours).
   2. Check the humidity within the system with a wet bulb indicator, and maintain the vacuum until the wet bulb temperature is reduced to -40°F. After the system has been evacuated and dried, break the vacuum by charging proper refrigerant into the system.

3.4 PIPE SIZE

A. Pipe shall be routed and sized per condensing unit manufacturer’s instructions.

3.5 MINIMUM HEIGHT

A. Exposed refrigerant piping installed in open spaces shall be installed 7’-3” or higher above finished floor.

3.6 REFRIGERANT PIPE ENCLOSURE

A. Refrigerant piping shall be protected by locating it within building elements when routed below 7’-3” above finished floor except where located within 6’-0” of the refrigerant unit.

3.7 PIPE IDENTIFICATION

A. Pipe identification shall be located at intervals not exceeding 20 feet on the refrigerant piping or pipe insulation.

B. The minimum height of the lettering of the identification label shall be ½”.

C. The identification shall indicate the refrigerant designation and safety group classification of refrigerant used in the piping system. For group A2, A3, B2, B3 refrigerants, the

identification shall also include the following statement: “DANGER – Risk of Fire or Explosion.” For any group B refrigerant, the identification shall also include the following statement: “DANGER – Toxic Refrigerant.”

3.8 REFRIGERANT PIPE PROTECTION

A. Where A2L and B2L refrigerant piping is located in concealed locations where the pipe is installed in studs, joists, rafters, or similar member spaces and located less than 1.5” from the nearest edge of the member, a shield plate shall be installed for continuous protection. Protective steel shield plates having a minimum of 16 gauge shall cover the area of the pipe plus the area extending 2” or more beyond both sides of the pipe.

B. Refrigerant piping shall be installed as to prevent strains and stresses that exceed the structural strength of the pipe. Pipe must be protected from damaging resulting from vibration, expansion, contraction, and structural settlement

3.9 CONTRACTOR DECLARATION

A. Installing contractor shall issue a certificate of test to the code official for all systems containing 55 lbs or more of refrigerant. The certificate shall include the test date, name of refrigerant, test medium and the field test pressure applied to the high-pressure side and the low pressure side of the system. The certification of the test shall be signed by the installing contractor and shell be made part of the public record.

3.10 STOP VALVES

A. Stop valves shall be installed on the suction inlet and discharge outlet of each compressor or condensing unit and outlet of each liquid receiver for systems containing more than 6.6 lbs of refrigerant.

B. In addition to part A. above, stop valves are also required on the inlet of each liquid receiver and inlet of each condenser where more than one condenser is used in parallel for systems containing more than 100 lbs of refrigerant.

C. Stop valves shall be identified where their intended purpose is not obvious.

END OF SECTION 23 23 00

SECTION 23 25 13 CIRCULATING WATER SYSTEM CHEMICAL TREATMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide equipment, chemicals and treatment materials for the complete water treatment system.

B. Determine which chemicals to use from the results of a water sample analysis taken from the building domestic water supply.

C. Provide water treatment products, holding reservoirs, equipment and labor for testing, cleaning, flushing and dispensing products to achieve the required water quality for each system specified.
1. Closed chilled and hot water systems
2. The cooling tower condenser water system
3. Closed condenser water system

1.2 SERVICE AND SUPPLIES

A. All work shall be performed by a qualified, full-time, Water Program Manager.
1. Specialist in the field of industrial water treatment.
2. Facilities include water analysis laboratory, development facilities and service department.

B. Provide a water treatment test set for each system (pH, alkalinity, hardness, chloride) for field use including test equipment and reagents as required for specific use with the treatment products employed.

C. Where specialized supplementary testing or control equipment is required, provide appropriate items.

D. Provide a water management and service program for a period of one year beginning at substantial completion. Make routine visits bi-weekly during first two months of operation and monthly during the remainder of the specified period.

E. Routing Services
1. Check and adjust water treatment system operation.
2. Instruct, train and advise operating personnel.
3. Check efficiency of chemicals and chemical applications.
4. Replenish chemicals and replace expendables.
5. Clean or replace filter in feeder.

F. Chemically clean the piping system.

G. Provide a complete laboratory analysis of water samples. Insert in the Owner's manuals.

H. Provide review of report figures in the field water testing.

1.3 QUALITY ASSURANCE

A. Acceptable program manager shall have:
1. Research and development facilities.

2. Regional laboratories capable of making water analysis.
3. A service department and qualified technical service representatives located within a reasonable distance of the project site.
4. Service representatives who are registered Engineers or factory-certified technicians with not less than 5 years of water treatment experience with the water treatment system manufacturer.

B. Ensure that all products, packaging, blow-down or other effluents do not violate local, state, or federal laws or regulations. Use only chemicals that are registered, when required, with the U.S. Department of Agriculture or the U.S. Environmental Protection Agency and that are labeled as required by law.

C. Provide electrical products that have been tested, listed and labeled by Underwriters Laboratories and comply with the National Electrical Manufacturers Association Standards.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Garret-Callahan

B. Nalco Chemical Company

2.2 CLOSED CHILLED AND HOT WATER SYSTEM

A. By-pass filter feeders in the hot water and chilled water systems:
1. Rated at 40-gpm capacity.
2. Operating conditions: 150 psig and 250°F.
3. Quick opening cap with a Buna N-O ring seal; or 1-1/2" valve and funnel.
4. 5 micron polypropylene filter bag mounted in a perforated stainless steel holder. Filter bag shall be supported from top of feeder.
   a. Filter bag and holder shall extend full length of feeder tank.
   b. Bottom feed tanks are not acceptable.
5. Fabricated hot dipped galvanized steel support legs and frame. Refer to detail drawing for requirements.
6. Provide sufficient quantity of filter bags for warranty period. Minimum of six additional bags provided to owner.

B. Acceptable Manufacturers
1. Neptune Model FTS-5
2. Efficiency Dynamics FF-100.
3. J.L. Wingert Model FHC-5HD.
4. Hydro-systems HS-800
5. Vector Industries, Inc. FA-900

C. Treatment chemicals:
1. Furnished as a concentrated liquid in 5 gallon pails
2. A corrosion inhibitor of the nitrite-borate type.
3. Maintained at a nitrite residual of 600 – 800 ppm in chilled loops and 1000-1500 in hot loops.
4. With effective copper, black iron, stainless steel and aluminum corrosion inhibitors.
5. Form a protective film to prevent corrosion and scale formation.

6. Have colored dye to indicate presence.

D. Multiple chemicals used in a common system shall be compatible.

E. Flow Indicator:
1. Bronze Construction
2. Rotating Wheel
3. Line Size
4. Double Window
5. Ernst Flow Industries Model EFIE-57-3

PART 3 - EXECUTION

3.1 INSTALLATION/START-UP

A. In accordance with manufacturer's recommendations.

B. Anchor the chemical filter feeder to a concrete housekeeping pad using wedge type expansion anchors.

D. Clean and flush closed loops systems.
1. Clear water flush systems before introducing chemical cleaners.
2. Chemical cleaner shall be introduced into the systems to remove construction related oils, greases, threading compounds, and silt.
3. Chemical Cleaner shall passivate and pre-film pipe system.

3.2 WATER ANALYSIS

A. The chemical treatment agency shall provide the services of a testing laboratory to perform a site water analysis. As a minimum, conduct the following tests in accordance with ASTM standards and to the satisfaction of the Owner/Architect/Engineer.
1. Silica in water and wastewater.
2. Acidity or alkalinity of water.
3. Iron in water.
4. Hardness of water.
5. Ph of water.
6. Particulate and Dissolved Matter, Solids or Residue in Water.
7. Turbidity in water.
8. Corrosivity of water in absence of heat transfer.
9. Standard practices for sampling water.

B. Take water samples in accordance with ASTM.

C. Prepare a test report in accordance with ASTM for each of the tests conducted.

D. Submit the test reports to the Architect/Engineer.

3.3 CHEMICAL TREATMENT

A. The chemical treatment agency shall provide complete services necessary for chemically cleaning and treatment the following systems:
1. Chilled water.
2. Hot water.
3. Condenser water.

B. The chemical treatment agency shall provide, but not be limited to the following:
   1. Equipment and installation.
   2. Chemicals.
   3. Analytical and testing work.
   4. Inspection.
   5. Calculations.
   6. Assistance to the trade installing the piping.
   7. Instruction to Owner.

C. Determine which chemicals to use from the results of site water analysis. Provide the chemical necessary to achieve the desired water condition.

D. Examine and supervise flushing and pipe cleaning operations and verify that the systems are clean, free of debris and rust and other construction materials before starting water treatment.

E. After the piping has been flushed, cleaned, rinsed and charged with chemicals, then start-up and operate the chemical treatment equipment to provide steady, stable characteristics for the systems treated.

F. During construction, instruct the Contractor in the field piping and wiring of chemical feeding equipment. If such piping and wiring details are not shown on the Contract Drawings, then provide all equipment, piping, wiring, instrumentation and chemicals to provide a complete and operating system without additional cost.

G. After the chemical treatment is functioning as intended, the chemical treatment agency shall demonstrate to the Architect/Engineer the chemical treatment operation.

3.4 OWNER TRAINING

A. A chemical treatment agency, in conjunction with the chemical treatment equipment manufacturer’s factory representative, shall train the Owner to operate and maintain the chemical treatment system as a whole and in part for each piece of equipment.

B. Furnish to the Owner a chemical treatment administration manual covering the chemical treatment program for each of the systems treated. The manual shall include, but not be limited to:
   1. Name, address and telephone number of the chemical treatment agency and each of the equipment manufacturers.
   2. Operation and maintenance manuals.
   3. Test reports.
   4. Chemical data sheets.
   5. A narrative describing the chemical treatment program for each of the systems being treated.

3.5 TESTING AND INSPECTION

A. After the systems have been accepted, the chemical treatment agency shall visit the site every month during the warranty period.

B. During each visit:
   1. Check and adjust the chemical treatment equipment.
   2. Check the chemistry of the treated system to confirm the chemicals are maintaining the system as intended.
   3. Advise and instruct the Owner on operational changes made to the chemical

treatment program.

4. Take a water sample of each system being chemically treated and have the samples tested by a testing laboratory. Prepare a report for each water sample and submit it to the Owner. Include in the test report the changes that need to be made to the chemical treatment program.
5. Maintain complete records of the treatment program for each system at the project site. Keep the records in a hardbound manual with the building manager. A second copy shall be maintained by the agency for the agency's records.

C. Routine visits must be coordinated with the Owner.

D. Send copy of monthly report to Engineer for Verification.

END OF SECTION 23 25 13

SECTION 23 31 13 DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

A. Division 23 Mechanical
1. Air Devices
2. Air Handling Units
3. Insulation
4. Terminal Units
5 Fan Coil Units
6. Fans
7. Testing, Balancing and Adjusting (TAB) of Environmental Systems

B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.

B. An approved contractor for this work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

C. The contractor shall ensure that all ductwork either stored on site of installed in the building is sealed to protect against dirt and moisture until such air handling equipment. Should ductwork not be sealed as specified, then the contractor shall have such ductwork professionally cleaned to an as-new condition at no cost to the District

1.4 GUARANTEE

A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.

B. Coordinate location of ductwork with structural members and Architectural drawings and

requirements.

1.6 SHOP DRAWINGS AND SAMPLES

A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and summit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.

B. Submit product data and sealing materials to be used.

C. Submit sound attenuation data.

D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing equipment in mechanical equipment areas.

PART 2 - PRODUCTS

2.1 STANDARDS AND CODES

A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

2.2 DUCT MATERIAL AND CONSTRUCTION

A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.

B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.

C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
1. Galvanized

D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.

E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.

F. Shower Area Exhaust Systems: Welded 304 Stainless steel.

G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge

2.3 ACOUSTICAL DUCT

A. Duct and fittings:
1. Double wall acoustically treated.
2. Annular space packed with fiberglass insulation.
3. Perforated metal liner to provide specific acoustic impedance

4. Insulation 1.0 pcf. 1 inch thick
5. United McGill Acousti-K27 spiral lockseam or approved equal
6. Material as indicated below:
   a. Paintable Galvanized Steel

B. Pressure rating and tests as specified for single wall ductwork.

2.4 DUCT SEALING OF SEAMS AND JOINTS

A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
   1. Indoor applications – Foster 32-14
   2. Outdoor applications – Foster 32-17

2.5 FLEXIBLE DUCT LOW PRESSURE

A. Construction:
   1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
      a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
   2. UL 181 Class I air duct label
   3. Reinforced vapor barrier jacket
   4. Rated for use at system pressure (6" wc minimum)
   5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.

B. Fire hazard classification:
   1. Flame spread rating 25 maximum.
   2. Smoke developed rating 50 maximum.

C. Thermal characteristics:
   1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
   2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
   3. 2" minimum wall thickness insulation with 1" overlap

D. Acceptable manufacturers:
   1. Flexmaster
   2. Hart & Cooley
   3. Omniair
   4. Peppertree Air Solutions

2.6 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.

B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:
Positive: 12" w.g.
Negative: 5" w.g.

C. The duct shall be rated for a velocity of at least 5500 fpm.

D. Suitable for operating temperature range of -20°F to +250°F.

E. Factory insulate the flexible duct with fiberglass insulation.
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
3. 2" minimum wall thickness insulation with 1" overlap

F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.

G. Acceptable manufacturers:
1. Flexmaster
2. Omniair
3. Peppertree Air Solutions

2.7 FIRE DAMPERS

A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.

B. Acceptable Manufacturers:
1. Ruskin
2. Prefco Products
3. Air Balance
4. Greenheck, Inc.
5. Nailor Industries
6. Pottoroff

2.8 CEILING RADIATION DAMPERS

A. Ceiling Radiation Dampers at location shown on plans constructed and tested in accordance with the current edition of UL555C of a minimum 22 gauge (0.8) blades, hinged in the center and held open with a 165° fusible link. Maximum blade height in the open position shall be 10" overall regardless of damper area. Maximum distance between blades held in the open position shall be 1-1/4" for units not requiring blade insulation and 1/4" for units with sheetrock blade insulation. Blades requiring radiation protection insulation shall utilize sheetrock. Refractory Ceramic or Mineral Wool Fiber is not allowed in the air stream. Radiation insulation outside of the air stream shall be Mineral Wool Fiber only. Ceramic Fiber Material is not approved for use. Units shall be constructed of a minimum 20-gauge (0.9) frame welded at all seams.

B. Acceptable Manufactures
1. Ruskin
2. Prefco
3. Air Balance
4. Phillips
5. Safe-Air
6. Nailor Industries

2.9 WALL LOUVERS

A. Refer to schedule on drawings. Coordinate with Architectural Drawings.

B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.

C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.

D. Louvers shall be AMCA-550 tested and approved.

E. Acceptable manufacturers:
1. American Warming and Ventilation
2. Arrow
3. Greenheck
4. NCA
5. Pottorff
6. Ruskin

2.10 FLUES FOR POWER EXHAUST AND HIGH EFFICIENCY BOILERS AND WATER HEATERS

A. Double wall air insulated positive pressure chimney equal to Metalbestos, Van-Packer, Schebler or Metal-Fab. Chimney shall be rated for 550°F maximum flue gas temperature and with a UL tested pressure rating of 40 inches w.c. The interior pipe shall be constructed of AL 29-4C stainless steel and the exterior pipe shall be constructed of 304 stainless steel. Stack system shall be complete with a one inch air gap between inner liner and outer cover. Chimney shall be constructed and installed per UL-1738 and NFPA-211. All accessories shall be made by the same manufacturer and designed to be a part of a positive pressure chimney system.

2.11 DUCT LINING

A. Duct lining shall be 1" thick, 1-1/2 lb. density, flexible lining coated on the air stream side to reduce attrition. Liner shall be Schuler Lina-Coustic, Certain-Teed Ultralite, or equal meeting requirements of NFPA 90-A. Provide I.A.Q. rated liner.

2.12 VOLUME DAMPERS

A. Manual balancing dampers that meet or exceed the following minimum construction standards:
1. Frame 16-gauge
2. Blades 16-gauge
3. Bearings corrosion resistant
4. Concealed linkage
5. Opposed blade dampers

B. Acceptable manufacturer:
1. Ruskin Model MD-35 or approved equal, by
2. Arrow
3. American Warming and Ventilating
4. Nailor Industries
5. Pottoroff

2.13 ACCESS DOORS

A. Round spin-in door of galvanized steel.
1. Fire proof sealing gaskets and quick fastening locking devices
2. Insulated door
3. Conform to the requirements of the NFPA
4. Identification and use of each access door
5. UL label to match the construction in which it is installed
6. Cable attached to door and outer frame
7. Low leakage Access Door

B. Acceptable Manufacturer
1. Flex master, Inspector Series
2. Approved Equal

2.14 COMBINATION FIRE/SMOKE DAMPERS

A. Combination fire/smoke dampers meeting the following requirements:
1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
5. Provide UL555S qualified electric actuator at 120 VAC.
6. Provide air-foil type blades.

B. Provide integral sleeves

C. Acceptable Manufacturers:
1. Ruskin

2. Air Balance, Inc.
3. Greenheck, Inc.
4. Nailor Industries
5. Pottoroff

2.15 SMOKE DAMPERS

A. Smoke dampers meeting the following requirements.
1. Each smoke damper shall be classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16 gauge, galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
4. Provide UL555S qualified electric actuator at 120 VAC.
5. Provide air-foil type blades.

B. Provide integral sleeves.

C. Acceptable Manufacturers:
1. Ruskin
2. Air Balance, Inc.
3. Greenheck, Inc.
4. Nailor Industries
5. Pottoroff

2.16 DIFFUSER FITTINGS LOW PRESSURE TAPS

A. Fitting shall meet or exceed the following minimum construction standards:
1. Conical with a base diameter two inches larger than the tap diameter.
2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
   a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
   b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
   c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
   a. Through 8 inches: 26 gauge; Damper blade 22 gauge
   b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge

c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge

4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
6. Provide the damper with a self-locking regulator and handle.
7. Provide a 2” sheet metal stand-off to extend the regulator.
8. Flex duct grip area – 2 inches behind retaining bead
9. Flex duct retaining bead – 1 inch from end
10. Conical length of at least 3 inches
11. Barrel length of at least 9 inches

2.17 AUXILIARY DRAIN PANS

A. Galvanized steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2”, all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

2.18 DUCTWORK SUPPORTS ON ROOF

A. Support ductwork on roof with Portable Pipe Hanger Model PHP-D fully adjustable height and width. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized framing. Nuts and washers shall be hot dip galvanized.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.

B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.

C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.

D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.

E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.

F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.

G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.

H. Fire Dampers shall be installed per manufacturer’s recommendations to create a UL

rated assembly.

I. Install end bearing at all location where damper shaft penetrates duct wall.

J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

3.2 DUCTWORK

A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.

B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.

C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.

D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.

E. Use pushrod operator with locking nut and butt hinges assembly.

F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
1. Return air ductwork
2. Outside air branch duct
3. Exhaust branch duct
4. Exhaust connections to hoods except kitchen grease hoods or equipment
5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
6. At each outside air and return air duct connection to plenum of constant volume units
7. At discharge side of constant volume boxes
8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.

G. Elbows:
1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the

same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.

2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.

H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.

I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.

J. Insulated Flexible Duct:

1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.
2. Construct bends over 45° with sheet metal elbows.

K. Duct Supports:

1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or 5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, “Everdur” welded and coated with “Galvabar”.

3.3 PLENUMS

A. Return air plenums shall be rectangular galvanized sheet metal ductwork.

B. Fabricate plenums upstream of fan of 16-gauge material.

C. Fabricate plenums upstream of filters minimum 18-gauge material.

3.4 FLEXIBLE CONNECTIONS

A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

3.5 ACCESS DOORS

A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:
1. Fire Dampers
2. Smoke Dampers
3. Smoke/fire Dampers
4. Outside Air Dampers
5. Duct Mounted Coils (up-stream and downstream)
6. Control Dampers

B. Size access door 1" smaller than ductwork.
1. Available Sizes: 8”, 10”, 12”, 18”, 24”

C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.

D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

3.6 DUCT LINING

A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.

B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.

C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.

D. Do not install liner in multi-zone unit ductwork.

3.7 SEALING OF SEAMS AND JOINTS

A. Seal supply, return, exhaust and outside air duct systems.

3.8 FLUES

A. Provide and install flues for all gas fired equipment.

B. Refer to plans for all related locations.

C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.

D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.

E. Terminate flues at height above roof to prevent flue gas from entering the building.

3.9 DISHWASHER HOOD EXHAUST SYSTEM

A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot to drain toward the washer.

3.10 SHOWER AREA EXHAUST SYSTEM

A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot slope down to grille connection. Install in accordance with Fig. 2-21 of SMACNA HVAC Duct Construction Standards.

3.11 KITCHEN EXHAUST DUCT

A. All material and fittings shall be minimum 16 gauge, coated black steel to prevent rusting. All seams and joints in the kitchen exhaust duct, and penetrations of the hood enclosure to its lower outermost perimeter that directs and captures grease-laden vapors and exhaust gases shall have a liquid tight continuous external weld. All ducts shall be installed without forming dips or traps that might collect residues. Provide 18" x 18" or equal area at each elbow and as required for cleaning access, in direction of air flow. UL Listed access panel shall be located on the vertical wall of the duct 1-1/2" from the bottom of duct and shall be fitted with two handles, grease and air tight fitting access door and latch. All interior surfaces of ducts shall be accessible for cleaning and inspection purposes. Duct shall maintain minimum 1/4" per lineal foot slope to the exhaust hood. Provide duct over lay at the roof curb for a complete seal. Install kitchen exhaust system per local authority. In the absence of a local authority, the requirements of the Uniform Mechanical Code and NFPA 96 shall govern.

3.12 FUME HOOD EXHAUST SYSTEM

A. All material and fittings shall be 304 stainless steel construction.

3.13 ACOUSTICAL DUCT

A. Install in the following locations:
   1. Where indicated on the drawings

3.14 SCREENS

A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2”) mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no

ductwork is connected.

3.15 CONNECTIONS TO LOUVERS

A. Make watertight connections to all louvers. Ductwork behind louver shall have watertight soldered joints for a minimum of three feet and be sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.

B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.16 PLENUMS

A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross broken and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.

B. Provide access doors.

3.17 AUXILIARY DRAIN PANS

A. Where coils that have a condensate drain are located above ceiling.

3.18 TESTING OF LOW PRESSURE DUCTWORK

A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.

B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.

D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

3.19 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

A. As the project progresses, test the ductwork in sections.

B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

C. Finally as a complete system, test ductwork at a minimum of 2.5” with a maximum allowable leakage of 1% of the total design supply airflow.

D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION 23 31 13

SECTION 23 34 16 FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

A. Division 23 Mechanical:
1. Ductwork
2. Vibration Isolation
3. Air Balance
4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.

B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.

C. Statically and dynamically balance all fans.

D. Motors shall be sized so that they do not operate within the motor service factor.

E. Fans shall be capable of 120% of the scheduled air capacities.

F. All static pressures shown on schedules are external to fans. Manufacturer shall add damper and accessory losses to scheduled value before selecting fan.

1.4 SUBMITTALS

A. Submit fan performance curves with system operating point plotted on curves.

B. Submit manufacturer’s printed installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. ACME

B. Cook

C. Greenheck

2.2 PROTECTIVE COATINGS

A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.

B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

2.3 SUPPLEMENTAL EQUIPMENT

A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.

B. Belt Drives:
1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.
2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
3. Provide belt guards and apply the same finish as used on the fan.
4. Oil and heat resistant, nonstatic type belts.
5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.

C. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.

D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.

E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.

F. Where motorized damper is scheduled:
1. The motor and damper are specified in the Building Management and Control System Specification.

G. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
1. Fan mark as indicated on the Contract Drawings.
2. Serial number
3. Model number
4. Capacity (CFM) and static pressure.
5. Motor HP
6. Motor Amps
7. Manufacturer

8. Motor phase
9. Number of Belts/Make/Size
10. Motor volts

H. Utility Vent Set Fans, provide minimum ¾ inch threaded coupling drain connection at lowest point of housing.

2.4 VENTILATION AND EXHAUST FANS

A. Provide the ventilation and exhaust fans shown on the drawings.

B. Provide each motor with internal overload protection.

C. Provide each belt driven fan with approved, totally enclosed belt guard.

D. Provide approved safety screen where inlet or outlet is exposed.

E. Provide duct flanges where required for connections.

F. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.

G. Furnish supply fans with 1” aluminum, washable filter section.

2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

A. Provide the rooftop ventilation and exhaust systems shown on the drawings.

B. Provide each motor with internal overload protection.

C. Components:
1. Aluminum, stainless steel or plastic coated bird guard.
2. Screws and fasteners of stainless steel or nonferrous material.
3. All aluminum construction unless indicated otherwise on fan schedule.

D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine allow aluminum.

E. Aluminum base shall be continuously welded curb cap corners.

2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

A. Provide the rooftop intake and relief vent systems shown on the drawings.

B. Provide with aluminum, stainless steel or plastic coated bird guard.
1. Screws and fasteners of stainless steel or nonferrous material
2. All aluminum construction

C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.

D. Aluminum base shall be continuously welded curb cap corners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings. Ensure fan location is installed at minimum distance from roof edge to meet code requirements.

B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.

C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer’s installation instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1” x ¼” gasket. Gasket shall be glued or attached with pressure sensitive adhesive.

D. Install curbs and equipment in level position.

E. Ceiling mounted in-line centrifugal blowers
   1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
   2. Provide sub-structure where required.
   3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

3.2 EXTRA MATERIALS

A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION 23 34 16

SECTION 23 36 16 VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install variable volume terminal units, including hangers, controls and other required elements.
   1. Provide constant fan variable volume terminal units where indicated on the drawings.
   2. Provide variable volume terminal units where indicated on the drawings.

1.2 RELATED WORK

A. Division 23 Mechanical.
   1. Ductwork.
   2. Air Balance.
   3. Electrical Requirements for Mechanical Work.
   4. Building Management and Control System.
   5. Vibration Isolation,

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.

1.4 SUBMITTALS

A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order. Submit internal wiring diagrams, installation and operation manual as a complete submittal package.

B. Submit certified sound power levels for both discharge sound and casing radiated sound in accordance with ARI 880-98 Certification Program. All NC levels shall be calculated using ARI 885-98, Appendix E attenuation factors for mineral ceiling.

C. Submit for each box the following information:
   1. Box size
   2. Inlet size
   3. Box number
   4. Box designation
   5. Minimum / Maximum Fan CFM
   6. L / R Coil connection
   7. GPM
   8. Motor HP
   9. NC Level
   10. External Static Pressure
   11. Scheduled MBH
   12. Actual MBH
   13. Heating Coil Pressure Drop (ft.)
   14. Entering and Leaving Water Temperature

15. Entering and Leaving Air Temperature

1.5 QUALITY ASSURANCE.

A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.

B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.

C. Sound power levels to occupied space shall not exceed NC-30 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Nailor

B. Price

C. Titus

2.2 BOX CONSTRUCTION

A. Galvanized 22-gauge steel casing with suspension lugs.

B. Lined with minimum 1.5 PCF / 1" thick fiber free
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.
3. Condensation on the exterior of the box is not approved.
4. Coat all cut edges of liner with NFPA approved sealant.
5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.

C. Provide access to controls, fan compartment, and unit servicing, without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.

D. Components shall be constructed of corrosion resistant materials.

E. Bearings shall not require lubrication.

F. Casing leakage shall not exceed 2.0% of scheduled design air flow at 3.0” WG interior casing pressure.

G. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.

H. The maximum overall height of the variable air volume unit shall not exceed available ceiling space.

I. Maximum static pressure drop of air through terminal box shall be 0.2” w.g.

J. Maximum velocity through duct inlet shall be 2,000 fpm.

2.3 COMPONENTS

A. The entire terminal unit, including the heating coil, shall be designed and built as a single unit.

B. Provide each unit with a primary variable air volume damper that controls the air quantity in response to a space sensor.

C. Each unit shall contain:
1. Fan and motor assembly. For Fan Powered Units Only
2. Heating coil.

D. Locate the heating coil in the discharge of the blower section.

E. Provide single point electrical connections for the entire unit. Entire assembly shall be UL or ETL Certified, electrical components shall be UL listed and installed in accordance with the National Electrical Code.

F. The variable air volume units provided by the manufacturer shall be the quietest design available from the manufacturer for the type specified.

G. Induced air filter frame for 1” thick disposable filter.

H. Sufficient power for the VAV unit DDC controller, electric actuator and other components necessary to satisfy the sequence of operation. Size each transformer for the total connected load plus an additional 25% of the connected load. Primary and secondary fuses housed in a fuse block.

I. Inlet attenuator for induction airside of box with liner to lower radiated noise.

2.4 BLOWER FAN AND MOTOR

A. Blower fan:
1. Constructed of steel.
2. Forward curved centrifugal wheel.
3. Dynamically balanced wheels.
4. Direct drive motors.

B. Motor
1. Ultra-high efficiency ECM motor technology

C. Motor current characteristics as scheduled. Coordinate motor voltage with Division 26. Verify voltage with Electrical Plans.
1. Thermal overload protection.
2. Sleeve bearings.

D. Provide isolation between fan motor assembly and unit casing.

E. Provide a manual speed control system to allow continuously adjustable fan speed from maximum to minimum.
1. Electronic speed control matched to operate with the motor.
2. Speed controller shall incorporate a minimum voltage stop to ensure motor cannot operate in a stall mode.

F. Fan disconnect switch. This is not to be used as a main disconnect switch.

G. Provide electric heating models with the following items:
1. Single point electrical connection
2. Line side disconnect switch
3. Motor fuse
4. Motor disconnect switch
5. Fan SCR and relay
6. Control transformer
7. Air flow switch
8. Heat contactors
9. Thermal Hi-Limit Auto Reset switch

2.5 PRIMARY AIR DAMPER AND ACTUATOR

A. The control actuator shall vary the primary air damper in response to the control signal.
1. Damper leakage at shutoff shall not exceed 2.0% at 1" WG pressure.
2. Locate the damper inside the unit.
3. Damper connection to the operating shaft shall be a positive mechanical connection.
4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open position.
6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.
7. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
8. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.

2.6 AIR FLOW CONTROL

A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
1. Air quantity shall be factory set.
2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
3. Control shall be pressure independent.
4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to a center averaging chamber to ensure the following performance:
a. Controller fidelity shall be +/-5% of set volume with a flex inlet configuration and inlet static variation of 0.5" WG to 6.0" WG.
5. Provide flow measuring taps and a flow chart with each unit for field balancing air flow.

B. HOT WATER HEATING COILS
1. Provide hot water heating coils sized as scheduled.
a. The hot water heating coil is specified to be provided and mounted under the work of this Section.
b. Coil access door upstream of coil.
c. Install coil with supply inlet at bottom and on leaving airside of coil.
d. Maximum static pressure drop of water through heating coil shall not exceed 10’ w.g.

e. Maximum static pressure drop of air through heating coil shall not exceed 0.25” esp

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.

B. Install each unit in accordance with the manufacturer's printed installation instructions.

C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
1. Provide sub-structure where required.
2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
3. Install units so that they are level and plumb.

D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.

E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.

F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.

G. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

H. All installation shall be in accordance with manufacturer’s published recommendations.

I. Provide clearance for inspection, repair, replacement and service. Ensure accessibility to all terminal unit electrical control panel doors, controllers and operators are located a minimum of 30 inches from all obstructions (walls, pipe, etc.).

J. Provide ceiling access doors or locate units above easily removable ceiling components.

K. Support units individually from structure. Do not support for adjacent ductwork. Terminal units shall be supported using unit’s hanger brackets and threaded rods.

3.2 MISCELLANEOUS CONTROLS

A. The following equipment items are to be furnished by Building Management and Control System and installed by Fan Powered Terminal Unit manufacturer:
1. Automatic temperature control card (DDC).
2. Damper actuator.

B. The following equipment items are to be furnished and installed by the Fan Powered Terminal Unit manufacturer:
   1. Damper.
   2. Multi-point flow sensor.
   3. Controller enclosure.
   4. Power transformer.

C. Coordinate the output voltage required by the Building Management and Control System.

D. Coordinate location of controller enclosure.

3.3 ACOUSTICAL PERFORMANCE TEST

A. Test each size for each type of variable air volume unit furnished on the project.

B. Test for radiated noise and discharge noise in all operational modes from minimum to maximum primary air settings; at inlet air pressures of 1 and 2 inches water column, and at primary air settings of 20, 40, 60 and 100 percent.

C. Testing shall be done by an independent testing laboratory. Sound values submitted shall be certified by the laboratory doing the testing. Testing laboratory must be approved by Engineer. Final testing and approval must be witnessed by Engineer.

D. Testing procedures shall be in accordance with ASHRAE Standard 130-96 and rated in accordance with ARI 880.

E. Test the unit complete with damper, coils and controls. The unit shall be operational and represent a final version of the units to be installed on the project.

F. If the units do not meet sound criteria, modify the units and retest at no additional cost to the Owner until the sound criteria is in accordance with Contract Documents. The variable air volume unit manufacturer shall be held liable for the costs associated with construction delays resulting from failed test, not to exceed the purchase order cost.

G. Sound Levels: Maximum sound power levels resulting from any box shall not exceed the following:

OCTAVE BAND CENTER FREQUENCY, Hz.						
	125	250	500	1000	2000	4000
Radiated SPL db	52	45	40	36	34	33
Discharge SPL db	44	37	31	27	24	22

   1. Sound power levels are referenced to 10-12 watts.
   2. Box inlet static pressure = 1-1/2”
   3. No discounting for roof effect, ceiling attenuation, lined duct, division of flow and other similar effects.

H. All terminal boxes shall be equipped with a sheetmetal elbow with liner connected to plenum air inlet.

3.4 SPARE PARTS

A. Provide one spare motor for each size box.

END OF SECTION 23 36 16

SECTION 23 36 17 DUAL DUCT VARIABLE VOLUME TERMINAL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install dual duct variable volume terminal units with mixing attenuator, including hangers, controls and other required elements.

1.2 RELATED WORK

A. Division 23 - Mechanical.
1. Ductwork
2. Air Balance
3. Electrical Requirements for Mechanical Work
4. Building Management and Control System

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

B. Coordinate the primary (input) voltage with the electrical power source. Refer to the Electrical Drawings for specific requirements.

C. Coordinate multi-point sensor locations with Building Management Control System contractor.

1.4 SUBMITTALS

A. Submit product data for control devices, terminal boxes, and similar equipment for review prior to placement of purchase order.

B. Submit for each box the following information:
1. Box size
2. Inlet size
3. Box number
4. Box designation
5. Minimum / Maximum CFM

1.5 QUALITY ASSURANCE.

A. Make air flow tests and sound level measurements in accordance with applicable ASHRAE Standards 130-96 and ARI 880-98.

B. Manufacturer shall certify cataloged performance and ensure correct application of terminal units.

C. Sound power levels to occupied space shall not exceed NC-30 as calculated using ARI 885-98 Appendix E attenuation factors for mineral tile ceiling.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nailor

B. Price

C. Titus

2.2 BOX CONSTRUCTION

A. Galvanized 22-gauge steel casing with suspension lugs.

B. Lined with minimum 1.5 PCF / 1.5" thick fiber free thermal and acoustical insulation.
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.
3. Condensation on the exterior of the box is not approved.
4. Coat all cut edges of liner with NFPA approved sealant.
5. Lining shall pass UL 181, NFPA 90A and ASTM C 665.

C. Provide access to controls without disturbing duct connections. Limit the size of access doors to 24 inches. Where required, provide multiple access doors. Gasket each door in the unit casing.

D. Components shall be constructed of corrosion resistant materials.

E. Casing leakage shall not exceed 2.0% of the maximum scheduled design airflow at 3” WG interior casing pressure.

F. Seal casing joints with approved adhesive if required to meet the maximum casing leakage rate.

G. The maximum overall height of the dual duct variable air volume unit shall not exceed available ceiling space.

H. Maximum static pressure through box shall not exceed 0.2” w.g.

I. Maximum velocity through inlets should not exceed 2,000 fpm.

2.3 COMPONENTS

A. Primary variable air volume damper that controls the air quantity in response to a space sensor.

B. Multi-point airflow sensors at locations as required by Building Management Control System.

C. Mixing attenuator.

2.4 PRIMARY AIR DAMPER AND ACTUATOR

A. The control actuator shall vary the primary air damper in response to the control signal.
1. Damper leakage at shutoff shall not exceed 2.0% of the maximum scheduled schedule design airflow at 3" WG inlet static pressure and be tested in accordance with ASHRAE 130.
2. Locate the damper inside the unit.
3. Damper connection to the operating shaft shall be a positive mechanical

connection.

4. Damper shall have bearings at all penetrations of inlet tube and terminal housing. Penetration of damper shaft in terminal lining shall have seal at surface of lining to prevent fiber entrainment through rotation of damper shaft.
5. Two damper stop pins shall be provided. One pin shall ensure damper cannot rotate beyond full closed position. One pin shall ensure damper cannot rotate beyond full open position.
6. Inlet tube shall have rolled bead (outward position) prior to penetration point of flow sensor tubing to provide stop point for hard duct and anchor point for flex duct.

2.5 AIR FLOW CONTROL

A. Provide a flow control device that will limit the maximum CFM of the unit to that scheduled on the drawings.
   1. Air quantity shall be factory set.
   2. Thermostat signal shall reset the flow control device to reduce primary air quantity to match load requirements.
   3. Control shall be pressure independent.
   4. Each terminal shall incorporate a flow cross sensor with pick-up points connected to a center averaging chamber to ensure the following performance:
      a. Controller fidelity shall be +/-5% of set volume with a flex inlet configuration and inlet static variation of 0.5" WG to 6.0" WG.
   5. Coordinate flow sensor locations with Building Management and Controls Contractor.
   6. Flow sensor tubing shall have gaskets at penetration point of inlet tube.
   7. Flow sensor shall be center averaging type. Non-center averaging flow sensors are not acceptable.
   8. Flow sensor tubing to be connected with brass barb fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver and store products in a clean and dry place. Protect products from the weather, dirt, dust, construction debris and physical damage.

B. Install each unit in accordance with the manufacturer's printed installation instructions.

C. Suspend each unit from 1/4" electroplated zinc thread rods secured from structure.
   1. Provide sub-structure where required.
   2. Mount bottom of terminal unit no more than 18" above the finish ceiling height.
   3. Install units so that they are level and plumb.

D. Install a straight length of rigid ductwork upstream of all boxes. Provide at least 3 primary air inlet diameters of straight ductwork upstream of the primary air inlet connections. Flexible duct connections at boxes are allowed but are not a substitute for the straight run of rigid duct. A maximum of 4' of flexible duct is allowed at each box. All changes in direction shall be made with rigid duct. Seal connection at box, as required to comply with system maximum allowable leakage.

E. Coordinate the location of each variable air volume unit to ensure proper clearance so that all components are accessible and not blocked by other trades. Provide no less than the code required clearances to electrical components.

F. Cover and seal the openings of the VAV inlets during construction to prevent the inside from getting dirty. Where VAV units are considered dirty, as determined by the Architect / Engineer / Owner, clean the VAV units with a vacuum machine, and then wipe all surfaces with a cleaning agent, using clean rags.

3.2 MISCELLANEOUS CONTROLS

A. The following equipment items are to be furnished by Building Management and Control System and installed by Fan Powered Terminal Unit manufacturer:
1. Automatic temperature control card (DDC).
2. Damper actuator.

B. The following equipment items are to be furnished and installed by the Dual Duct Unit manufacturer:
1. Damper.
2. Multi-point flow sensors.
3. Controller enclosure.

C. Coordinate location of controller enclosure, inlet sensors, wiring of terminal equipment controller and transformer required by the Building Management and Control System contractor.

END OF SECTION 23 36 17

SECTION 23 37 13 AIR DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

A. Division 23 Mechanical.
1. Ductwork.
2. Air Balance.
3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.

B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

2.2 ACCEPTABLE MANUFACTURERS

A. Nailor Industries.

B. Price

C. Titus

2.3 ACCESSORIES

A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct.

Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a

square control rod equipped with a locking quadrant.

B. Mounting Frames. Provide each grille or register not equipped with a removable core with a companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.
   1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
   2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

PART 3 - EXECUTION

3.1 INSPECTION

A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

3.2 INSTALLATION

A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

END OF SECTION 23 37 13

SECTION 23 41 00 AIR FILTRATION

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air filters and air filter gauges.

1.2 RELATED WORK

A. Division 23 Mechanical.

1.3 SUBMITTALS

A. Submit manufacturer's product data sheets and capacity information as specified.

B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS

A. The filter cells:
1. Pleated media.
2. Disposable type.
3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
4. 16 pleats per linear foot of filter.
5. 2" thick.
6. Minimum MERV 10 Rating

B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
1. Seal the media pack in a chipboard frame.

C. Rated average dust spot efficiency of not less than 36%.
1. Average synthetic arrestance in excess of 93% when tested in accordance with the ASHRAE 52-68 test standard.

D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.

E. Initial resistance to air flow:
1. 300 fpm - 0.12" WG.
2. 500 fpm - 0.28" WG.

F. UL listed with Class II rating.

G. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the filters and filter gauges in accordance with the manufacturer's instructions.

B. Throughout construction, the contractor shall be responsible for monitoring filter loading and replacing filters to ensure construction debris is not passing through filters into equipment. Where dust and debris is found in coils and equipment the contractor will be responsible for cleaning coils and equipment to restore to like new condition.

C. Contractor shall maintain all air filters from startup through substantial completion: a clean set of filters are to be installed when needed by Testing and Balancing.

D. The contractor shall replace ALL air filters no more that one week prior to substantial completion.

END OF SECTION 23 41 00

SECTION 23 52 35 GAS-FIRED MODULATING HOT WATER BOILER (Condensing)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section specifies a packaged, gas-fired, power type condensing stainless steel boiler complete with all controls and trim for indoor installation.

B. Each factory "packaged" boiler shall be complete with all components, accessories and appurtenances necessary for a complete and operable boiler as hereinafter specified. Each unit shall be furnished factory assembled with required wiring and piping as a self-contained unit. Each unit shall be readily transported and ready for installation.

C. Each factory "packaged" boiler, including pressure vessel, trim, valve trains, burner, control system, and all related components, accessories and appurtenances as herein specified shall all be assembled and furnished by the boiler manufacturer. The boiler manufacturer shall provide unit responsibility for the engineering, coordination, workmanship, performance, warranties, and all field services for each factory "packaged" boiler as specified herein. The boiler manufacturer shall be fully responsible for all components assembled and furnished by him whether or not they are of his own manufacture.

1.2 RELATED WORK

A. Division 23 - Mechanical
1. Hot Water Piping
2. Gas Piping
3. Ductwork

1.3 PERFORMANCE

A. Provide performance as scheduled on drawings. Boiler shall be certified for up to 99% efficiency.

1.4 WARRANTIES

A. Boiler shall be provided with a 5 year complete parts and labor warranty from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Aerco

B. Hydrotherm

C. Patterson Kelly

2.2 PERFORMANCE CRITERIA

A. Each boiler shall be capable of operating continuously at rated capacity while maintaining a

CSA certified efficiency of not less than 92% on 500 MBH input boilers and less and not less than 95% on larger than 500 MBH input boilers. Each boiler shall be capable of operating with a minimum outlet water temperature of 68 deg. F.

B. Boiler shall comply with ASME Section IV for 80 psig, max 200 deg. F (100 psig on 1500 MBH and larger units).

C. Fuel shall be natural gas with an assumed higher heating value of 1,030 Btu/Cu Ft and an assumed specific gravity of 0.60 (relative to air). Natural gas shall be supplied at a pressure of no less than 3.5-inch WC to the inlet gas valve. Maximum inlet gas pressure shall not exceed 14-inch WC.

D. Boilers shall be certified for low NOx by the TCEQ. NOx emissions shall not exceed 30 PPM when referenced at 3% O2 at all firing rates.

E. The burner, gas train and controls shall conform to the requirements of I.R.I. /G.E. Gap.

2.3 BOILER DESIGN

A. Each hot water boiler shall consist of a horizontal, stainless steel heat exchanger complete with trim, valve trains, burner, and boiler control system. The boiler manufacturer shall fully coordinate the boiler as to the interaction of its elements with the burner and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

B. Each boiler heat exchanger shall be stainless steel, counter-flow design for maximum heat transfer with the multiple sections arranged in a reverse return configuration to assure balanced flow through each section

C. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.

D. All boiler pressure parts shall be constructed in accordance with the latest revision of the ASME Boiler and Pressure Vessel Code, Section IV, and shall be so stamped.

F. Boiler heat exchanger headers shall be fabricated steel and be completely removable for inspection. Seals shall be EPDM, rated for 400 deg F service. Push nipples or gaskets between the sections are not permitted.

G. Boiler shall be enclosed with a single wall outer casing. It shall be fabricated from minimum 16-gauge carbon steel. The front and top wall shall be secured in place with ¼ -20 NC bolts (sheet metal screws are not acceptable). The complete outer casing shall be finished, inside and out, with a powder coat finish. The composite structure of the boiler combustion chamber, insulating air gap and outer casing shall be of such thickness and materials to assure an outer casing temperature of not more than 50°F above ambient temperature when the boiler is operated at full rated load.

H. An observation port shall be located on the boiler to allow for observation of the burner flame.

I. Boiler shall have a single condensing heat exchanger. A boiler that utilizes a secondary condensing heat exchanger is unacceptable.

2.4 BOILER TRIM

A. Each boiler shall be provided with all necessary trim. Boiler trim shall be as follows:
1. Safety relief valve shall be provided in compliance with the ASME code. Contractor is to pipe to acceptable drain.
2. Water pressure-temperature gauge.
3. Primary low water flow fuel cutoff (probe type with manual reset).
4. Manual reset high limit water temperature controller.
5. Operating temperature control to control the sequential operation of the burner.
6. Separate inlet and outlet water temperature sensors capable of monitoring flow
7. Exhaust temperature sensor
8. Provide condensate neutralization kit (shipped loose).

2.5 BOILER FUEL BURNING SYSTEM

A. The boiler manufacturer shall furnish each boiler with an integral, power type, straight gas, fully automatic fuel burner. The fuel burner shall be an assembly of gas burner, combustion air blower, valve train, and ignition system. The burner manufacturer shall fully coordinate the burner as to the interaction of its elements with the boiler heat exchanger and the boiler control system in order to provide the required capacities, efficiencies, and performance as specified.

B. Each burner shall be provided with an integral gas firing combustion head.

C. Each burner shall provide adequate turbulence and mixing to achieve proper combustion without producing smoke or producing combustibles in the flue gases.

E. Each boiler shall be provided with an integral variable speed power blower to premix combustion air and fuel within the blower. The combustion air blower shall have sufficient capacity at the rated firing rate to provide air for stoichiometric combustion plus the necessary excess air. Static and total pressure capability shall comply with the requirements of the boiler. The blower shall operate at 6000 RPM maximum without undue vibration and noise and shall be designed and constructed for exposure to temperatures normal to its location on the boiler. The operating fan speed will be tachometer sensed and be capable of being displayed at the text based display.

F. Each burner shall of the radial-fired (down-fired) type and constructed of steel with a stainless steel inner and stainless steel mesh outer screen.

G. Each boiler shall be provided with a “Full Modulating” firing control system whereby the firing rate is infinitely proportional at any firing rate between 20% and 100% as determined by the pulse width modulation input control signal. Both fuel input and air input must be sequenced in unison to the appropriate firing rate without the use of mechanical linkage.

H. The Micro Processor shall use a Proportional Integral Algorithm to determine the firing rate. The control must have the following capabilities:
1. Maintain single set point
2. Reset the set point based on outdoor air temperature.
3. Boiler shutdown based on outdoor air temperature
4. Internal dual set point program with an external switchover. (e.g. - night setback w/external clock, supplied by others)
5. Alarm relay for any for any manual reset alarm function.
6. Programmable Low Fire Delay to prevent short cycling based on a time and

temperature factor for release to modulation.

7. Text Based Display showing current supply and return temperatures, current set points as well as differential set points. It must also display any fault codes whether automatically reset or manually reset.
8. Local Manual Operation.
9. Remote Control System (Building Management / Sequencer Control) - The boiler control shall be capable of accepting a 0 -10vdc remote external analog signal to control the firing rate
10. Computer (PC) interface for programming and monitoring all functions

2.6 MAIN GAS VALVE TRAIN

A. Each boiler shall be provided with an integral main gas valve train. The main gas valve trains shall be factory assembled, piped, and wired. Each gas valve train shall include at least the following:

1. Two (2) safety shutoff valves. Valves equipped with dual solenoids that can independently energized for leak testing.
2. Air – Gas ratio control (maximum inlet pressure 14-inch WC)
3. One (1) low gas pressure switch (manual reset).
4. One (1) high gas pressure switch (manual reset).
5. Two (2) pressure test ports

2.7 IGNITION SYSTEM

A. Each boiler shall be equipped for direct spark ignition

2.8 COMBUSTION AIR CONTROL SYSTEM

A. Each boiler shall be provided with an integral combustion air control system. The combustion air system shall be factory assembled. Each combustion air control system shall include at least the following:

1. The primary control shall vary the speed of the blower based on load demand. The blower shall apply a varying negative pressure on the gas valve which will open or close to maintain zero pressure at the valve orifice, thereby increasing or decreasing the firing rate. Both the air and gas shall be premixed in the blower.
2. One (1) low airflow differential pressure switch to insure that combustion air is supplied.
3. High exhaust back pressure switch

2.9 BURNER CONTROL SYSTEM

A. The control system shall be supplied with a 24 VAC transformer (120 VAC, single phase, 60 hertz primary). The 120/1/60 power supply to each boiler shall be protected by a 15 Amp circuit breaker located in the MCC (supplied by contractor).

B. The boiler shall include an electric spark ignition system. Main flame shall be monitored and controlled by flame rod (rectification) system.

C. Each boiler shall be provided with all necessary controls, all necessary programming sequences, and all safety interlocks. Each boiler control system shall be properly interlocked with all safeties.

D. Each boiler control system shall provide timed sequence pre-ignition air purge of boiler co

mbustion chamber. The combustion airflow sensor shall monitor and prove the airflow purge.

2.10 BOILER CONTROL PANEL

A. The boiler manufacturer shall provide each boiler with an integral factory prewired control panel. The control panel shall contain at least the following components, all prewired to a numbered terminal strip:
1. One (1) burner "on-off" switch.
2. One (1) electronic combination temperature control, flame safeguard and system control.
3. Control circuit breaker, 5 amp
4. All necessary control switches, pushbuttons, relays, timers, terminal strips, etc.
5. Text Based Display Panel to adjust set points and control operating parameters. Text Based Display is to indicate burner sequence, all service codes (0-65), fan speed, boiler set point, and sensor values such as inlet, outlet, flue gas and outdoor air.

2.11 FACTORY TESTING - HYDROSTATIC

A. Each factory "packaged" boiler shall be hydrostatically tested and bear the ASME “H” stamp.

2.12 FACTORY TESTING - FIRE TESTING

A. Each factory "packaged" boiler shall be fire tested. The boiler manufacturer shall perform this fire test under simulated operating conditions, with the boiler attached to a working chimney system and with water circulating through the boiler. The manufacturer shall provide a fire test report, including fuel and air settings and combustion test results permanently affixed to the boiler.

2.13 SEQUENCE CONTROLLER

A. Boiler shall be provided with a boiler sequence controller that is capable of controlling a) one or multiple boilers, b) all condensing or all non-condensing boilers, c) combination of condensing and non-condensing boilers (hybrid system). When controlling hybrid systems, sequence controller shall sequence the lead boiler based on its condensing capabilities to provide the most efficient operation. Controller shall be capable of communicating via MODBUS protocol. Controller shall allow boiler or boilers to operate off of a remote header sensor (header sensor provided by boiler manufacturer, installed by contractor). Controller shall be capable of allowing boiler or boilers to operate based on outdoor reset, see specification Section 23 09 33 for reset schedule. This shall be achieved by either, a) programming the controller with an outdoor air reset curve in conjunction with a separate outdoor air sensor (outdoor sensor shall be provided by boiler manufacturer, installed by contractor), b) setpoint control via 0-10 VDC analog communication with building automation system, c) setpoint control via MODBUS communication. Controller shall visually display relay status, firing rate of each boiler, header temperature, outdoor air temperature. Coordinate wiring of this controller with mechanical and control’s contractor.

2.14 CARBON MONOXIDE MONITORING SYSTEM

A. Provide and install a manual reset Carbon Monoxide Detector located within the boiler room. The Carbon Monoxide Detector and the boilers shall be interlocked so that the burners will not operate when the level of CO in the room rises above 50ppm. The Carbon Monoxide

detector shall disable the boiler's burner upon loss of power to the detector.

B. Carbon Monoxide Sensor with two year warranty by U.S. Draft Co. Model CGM-605 with model XB expansion module or equivalent by International Gas Detectors (IGD)
   1. Provided with pre-programmed dry contacts to shut down equipment during unsafe operation.
   2. NEMA 1 Enclosure
   3. Complies with Texas State Boiler Code 65.603-2015
   4. Additional features shall include 0-10 VDC control signal out, visual alarm and audible alarm.
   5. Provide expansion board for additional equipment interlocks.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install isolation valves and unions on supply and return water lines to boiler.

B. Install strainer, drain with valve, pressure and temperature gauge on return water line to boiler.

C. Install main gas cock, drip leg and union close to boiler.

D. Install on 4" concrete pad and place into operation in accordance with manufacturer's instructions. Pipe as detailed on drawings.

F. Provide Category IV vent stack material. Mechanical contractor shall coordinate draft requirements and other venting requirements between stack supplier and boiler supplier.

G. Install boilers, piping and accessories in accordance with the manufacturer's installation instructions and state boiler code.

H. Pipe each gas relief vent to the outdoors, in accordance with the manufacturer's recommendations and the local codes.

I. Contractor must, when filling the system, verify that the pH level is maintained between 6.0 and 8.5.

J. Contractor to route condensate connection off of boiler and stack to acid neutralization kit and then to appropriate drain. Trap as required by boiler manufacturer.

3.2 BOILER MANUFACTURER STARTUP SERVICE

A. Provide factory authorized startup services to assure its proper operation.

B. Set the boiler operating and safety controls.

C. Perform a flue gas analysis at the boiler outlet. Record the following results of the analysis:
   1. Carbon dioxide percent volume.
   2. Oxygen percent volume.
   3. Stack temperature.
   4. Calculated combustion efficiency.

D. Do not operate the boiler for any reason until the factory startup service has been completed.

E. Startup procedure shall include a functional test of Carbon Monoxide Detector. Simulate an alarm condition and demonstrate the functionality of the detector shutting down the appliances. Owner/Engineer shall be present to witness test.

END OF SECTION 23 52 35

SECTION 23 63 00 AIR-COOLED CONDENSING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

A. Refrigerant Piping.

B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. AAON

B. Carrier

C. Trane

2.2 COMPRESSOR

A. Provide a hermetic or semi-hermetic compressor with crankcase heaters, inherently protected motors, spring mounts and capacity modulation.

B. Unit shall include a factory holding charge of R32 or R454B refrigerant and oil.

C. Unit shall be provided with a minimum of two circuits and contain a minimum of a one digital scroll compressor.

D. Provide unit with compressor blankets to reduce compressor breakout noise.

E. Stop valves shall be installed on the suction inlet and discharge outlet of each compressor or condensing unit and outlet of each liquid receiver for systems containing more than 6.6 lbs of refrigerant. In addition, stop valves are also required on the inlet of each liquid receiver and inlet of each condenser where more than one condenser is used in parallel for systems containing more than 100 lbs of refrigerant.

2.3 CONDENSER COILS

A. Provide copper tubes with mechanically bonded aluminum fins. Protect condenser coils with a heavy gauge, corrosion resistant wire guard.

B. Provide condenser coil coated with corrosion resistant epoxy utilizing a dip and bake process. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

2.4 FANS AND MOTORS

A. Provide propeller-type fans with direct drive or belt drive and vertical discharge. Protect fan with a heavy-gauge, corrosion resistant wire guard. Provide inherently protected, permanently lubricated, and weatherproof motors.

2.5 CASING

A. Furnish a unit designed for outdoor mounting. Fabricate the casing of heavy gauge steel, zinc coated and finished with enamel. Provide removable access panels.

2.6 CONTROLS

A. Provide safety and operating controls factory wired and mounted in a separate enclosure. Include thermostatic expansion valve, high and low pressure switches and compressor motor overload devices. Furnish a time delay device to prevent short cycling. Employ a control transformer, a pressure relief device and suction and discharge valves with service connections.

2.7 THERMOSTAT

A. Low voltage, 7-day programmable thermostat is a component of the unit manufacturer unless specified in another Section.
1. Individual Heating/Cooling setpoints.
2. Automatic Heat/Cool change-over.
3. Sub-Base On-Off-Auto fan selection.
4. Sub-Base Heat-Off-Cool-Auto system selection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install removable core refrigerant filter dryer and sight indicating glass.

3.2 CONTROL WIRING

A. Furnish and install control wiring as required. Install control wiring in conduit.

3.3 CONTRACTOR DECLARATION

A. Installing contractor shall issue a certificate of test to the code official for all systems containing 55 lbs or more of refrigerant. The certificate shall include the test date, name of refrigerant, test medium and the field test pressure applied to the high-pressure side and the low pressure side of the system. The certification of the test shall be signed by the installing contractor and shell be made part of the public record.

3.4 START UP

A. Provide the services of a factory trained service technician employed full time by the unit manufacturer to start-up the system, or manufacturer's factory authorized representative

under the supervision of the factory trained service technician. Upon completion of the installation, the system shall be started and commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system. The factory authorized representative will verify that accessories are installed and performing the specified functions. (Contractor startup is unacceptable.)

B. The written startup report shall be provided to the owner and engineer upon completion.

END OF SECTION 23 63 00

SECTION 23 65 28 AIR-COOLED VARIABLE SPEED ROTARY SCREW CHILLER

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and Install a packaged, electric-driven, air-cooled, water chilling unit with variable speed rotary screw compressors complete with controls.

1.2 RELATED WORK

A. Division 23 – Mechanical:
   1. Chilled Water Piping
   2. Insulation
   3. Building Management Control System
   4. Vibration Isolation.
   5. Electrical Provisions of Mechanical Work.

1.3 REFERENCES

A. ANSI/ARI 550/590 - Water Chilling Packages using the Vapor Compression Cycle.
B. ANSI/ASHRAE 15 - Safety Code for Mechanical Refrigeration.
C. ANSI/ASHRAE ASHRAE 90.1-1999 Minimum Chiller Efficiency Requirements
D. ANSI/ASME SEC 8 - Boiler and Pressure Vessel Code
E. ANSI/NEMA MG 1 - Motors and Generators.
F. ANSI/UL 465 - Central Cooling Air Conditioners.
G. ANSI/AFBMA 9-1978 - Load Ratings and Fatigue Life for Ball Bearings. Bearings must have life of not less than 200,000 hours.
H. ASTM B117 - Standard Method of Salt Spray (Fog) Testing
I. ASTM A123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
J. ASTM A525 - Zinc (Hot-Dip Galvanized) Coatings on Sheet Steel Products
K. ASTM D1654 - Evaluation of Painted or Coated Specimens, Subjected to Corrosive Environments

1.4 PERFORMANCE

A. Provide performance as scheduled on drawings. Provide factory run test to ensure proper chiller operation. Provide certified documentation to Owner in Closeout Documents.

1.5 WARRANTY

A. The Chiller manufacturer shall provide a full machine parts, labor, and refrigerant warranty for a period of five (5) years from substantial completion.
   1. The warranty shall include, but not be limited to the compressor assemblies including motor, condensers, fans, variable frequency drives, controls, evaporator, condenser, refrigeration system and all other auxiliary components and accessories as well as refrigerant and oils in systems.
   2. In the event of failure, provide new or factory authorized rebuilt parts. Shop or job site rebuilt parts are not acceptable.
   3. On all manufacturers warranties the chiller manufacturer shall provide a factory certificate listing as a minimum chiller model, serial, and warranty information as specified above. Each chiller tag shall be provided with an individual and unique warranty certificate. Manufacturer's representative warranty letters are not acceptable as an alternative to the original manufacturer's certificates.

4. The chiller manufacturer authorized service agency is required to perform any and all warranty service. Contractor warranty service is not authorized. Warranty work shall be performed with District Representative present.

1.6 SUBMITTALS

A. Submit manufacturer's certified computer generated performance and capacity data in accordance with specification requirements.

B. Submit the following information:
1. Manufacturer's installation instructions.
2. Minimum Circuit Ampacity.
3. Maximum Overcurrent Protection size.
4. Maximum conductor / Terminal Lug size.
5. Minimum flow thru evaporator.
6. Electrical interlocks.

C. Submit recommended clearance dimensions for air flow and service.

D. Submit coordination drawings as specified.
1. Give consideration to adjacent structures as they affect air flow patterns.

E. Submit internal wiring diagram of Control Center.

F. Submit sequence of operation in narrative form.

G. Submit a letter stating chiller being proposed meets the efficiency requirements of Centerpoint Energy's Score Program listed in Centerpoint Energy's Design Guide: HVAC Recommendations document.

H. Mark-up a copy of the specifications, indicating in the margin of each paragraph, the following: COMPLY, DO NOT COMPLY, NOT APPLICABLE.

1.7 STORAGE/HANDLING/SHIPPING

A. Comply with manufacturer's installation instructions for rigging, unloading, and transporting units.

B. Protect units from physical damage. Factory coil shipping covers shall be kept in place until installation.

C. Unit controls shall be capable of withstanding 203°F (95°C) storage temperatures in the control compartment for an indefinite period of time.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Trane

C. Quantech

2.2 COMPRESSORS

A. Provide a minimum of two independently circuited semi-hermetic direct drive, variable speed rotary screw compressors with the following:
   1. Rubber isolation pads.
   2. Crankcase heaters.
   3. Semi-hermetic motor.
   4. Oil sight glass.
   5. Load and unload solenoid valves.
   6. Discharge oil separator.

B. Provide compressor with automatic capacity reduction equipment consisting of a capacity control variable speed drive. The controls system logic must start the compressor at minimum speed for a soft start.
   1. Control to be based upon leaving chilled water.

C. Ultra-Low Sound Compressor Control: Chiller manufacturer shall provide the following attenuation package and meet scheduled maximum A-weighted sound pressure level rating of 70dBA at 30' from the condenser coil side of chiller per AHRI. Complete sound attenuation package shall be provided regardless if scheduled dBA is met without.
   1. Provide ultra-low sound blanket on a minimum of 100% coverage of each compressor, suction line, discharge line and oil separator.
   2. Removable Sound Covers shall be constructed with a Silicone-fiberglass cloth outer jacket, a loaded vinyl barrier septum, fiberglass needle mat (11 lbs./ft.3 density), and a Silicone-fiberglass cloth inner jacket. The covers shall be connected together by means of a cloth straps with "D" rings and Velcro fasteners. The inner and outer jackets shall protect against UV rays, oil and water. Finished Surface Mass – 3 lbs. per sq. ft., to cover compressors and extended components for the specified chiller. Stainless steel wire tie fastening assemblies are not acceptable.
   3. Provide detailed ultra-low sound acoustical data with submittal. Data shall include sound pressure rating across each octave band and A-weighted average for chiller as built with attenuation package.

2.3 CONDENSER COILS

A. Coils shall be one of the following:
   1. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannel layered between the refrigerant manifolds. Tubes shall be 9153 aluminum alloy. Tubes made of 3102 alloy or other alloys of lower corrosion resistance shall not be accepted. Long Life Alloy Microchannel shall pass 4500hr salt spray rating uncoated.
   2. The condenser coils shall consist of 0.375 inch seamless copper tubes mechanically bonded into plate-type fins. The fins shall have full drawn collars to completely cover the tubes.

B. Protect all vertical or angled coil sections from hail or physical damage with corrosion resistant hail guard.

C. Chiller shall be capable of stable operation in ambient temperatures down to 15°F and temperatures up to 130°F.

D. Protect condenser coils during shipping.

E. Provide condenser coils coated with corrosion resistant epoxy utilizing a dip and bake. Coating shall be flexible and uniformly bonded to all condenser coil surfaces.

2.4 FANS AND MOTORS

A. Direct drive propeller type fans.
   1. Vertical discharge with sound reduction.
   2. Protect fan blades with a heavy-gauge wire guard.
   3. Statically and dynamically balanced
   4. Sound reduction type fan blades and shrouds
   5. All condenser fans shall have integral drives to provide variable speed for optimized efficiency.

B. Motors with built in thermal overload protection
   1. Permanently lubricated ball bearings.
   2. Weatherproof (TEAO or TEFC) motors.
   3. All condenser fans shall have integral drives to provide variable speed for optimized efficiency.

2.5 EVAPORATOR

A. Provide either a tube-in-shell direct expansion cooler or a brazed plate heat exchanger
   1. Tube-in-shell direct expansion cooler
      a. Copper tube and steel shell construction
      b. 300 psig water side working pressure
      c. ASME coded 225 psig refrigerant side working pressure
      d. Fully independent refrigerant circuit for each compressor.
      e. Serviceable construction including removable heads and field replaceable tubes.
      f. Drain and vent connection.
      g. Inlet strainer.
   2. Brazed plate heat exchanger with:
      a. Stainless steel with copper braze material
      b. 150 psig water side working pressure
      c. ASME coded 430 psig refrigerant side working pressure
      d. Fully independent refrigerant circuit for each compressor.
      e. Serviceable construction including removable heads and field replaceable tubes.
      f. Drain and vent connection.
      g. Heat exchanger inlet strainer.

B. Protect cooler with ambient controlled heater cable and minimum 1-1/4" thick flexible elastomeric rubber closed cell insulation. Heater cable to protect evaporator to -20ºF (-29ºC). Heater cable shall be wrapped helically around the shell under the insulation.

C. Protect insulation and equipment from abrasion by unit enclosure.

D. After completion of successful start-up, installing contractor shall seal all openings and apply a protective aluminum sheet metal cover.

E. Provide water drain connection, vent and fittings for factory installed leaving water temperature control and low temperature cutout sensors.

F. Water connections shall be grooved or flanged.

G. Proof of flow shall be provided by the equipment manufacturer factory installed.

2.6 CASING/ENCLOSURES

A. House components in minimum 12 gauge galvanized steel frame and mounted on welded structural steel base. Hot-dip galvanized steel frame coating shall be Underwriters Laboratories Inc. (UL) recognized as G90-U, UL guide number DTHW2.

B. Unit panels, and control panels shall be finished with a baked on powder paint. Control panel doors shall have door stays.

C. Mount starters and disconnects in weatherproof panel provided with full opening access doors. Provide lockable disconnect operating handle external to panel and clearly visible from outside of unit indicating if power is on or off.

D. Casings fabricated from steel that do not have a Zinc coating conforming to ASTM A 123 or ASTM A525 shall be treated for the prevention of corrosion with a factory coating or paint system. The coating or paint system shall withstand 500 hours in a salt-spray fog test in accordance with ASTM B 117. Each specimen shall have a standard scribe mark as defined in ASTM D 1654. Upon completion of exposure, the coating or paint system shall be evaluated and rated in accordance with procedures A and B of ASTM D 1654. The rating of failure at the scribe mark shall be not less than six (average creepage not greater than 1/8"). The rating of the unscribed area shall not be less than ten (no failure). Thickness of coating or paint system on the actual equipment shall be identical to that on the test specimens with respect to materials, conditions of application, and dry-film thickness.

E. Coated wire mesh to limit access beneath the condenser coils, cooler, and compressor section area.

F. Convenience outlet (GFIC) at control panel connected to 120-vac circuit provided for heat tracing on cooler.

G. A control power transformer shall be factory installed to provide unit control power.

2.7 REFRIGERANT CIRCUIT

A. All units shall be provided with factory refrigerant charge of R513a.

B. All units shall have a separate independent refrigerant circuit for each compressor.

C. Provide for each refrigerant circuit:
1. Liquid line isolation valve.
2. Filter dryer (replaceable core type).
3. Liquid line sight glass and moisture indicator.
4. Electronic expansion valve sized for maximum operating pressure. Expansion valves with less than five years of proven field operation are not acceptable.
5. Charging valve.
6. Discharge and oil line check valves.
7. Compressor suction and discharge service valves.
8. Relief valve.
9. Full operating charge of refrigerant and oil.

2.8 CONTROL PANEL

A. The Control Center.
1. NEMA 3R weatherproof cabinet with hinged lockable outer door.
2. Control system.

3. Solid-state compressor three phase motor protection.
4. Single point field power connection points.
5. Control interlock terminals.
6. Fan motor and control circuit fuses.
7. Individual contactors for each fan motor.
8. Unit power terminal blocks for connection to remove disconnect switch.
9. Power supply terminals for evaporator heater circuit.
10. Dead front panels over line voltage.
11. Control power / circuit transformer.
12. Provide incoming power terminals, sized to accept the feeder conductors.
13. Pump output relay for chilled water pump control
14. Freeze protection and low limit control of pumps
15. Chiller run and alarm status relay cards.

B. Microprocessor control system.
1. Stage unit based on leaving water temperature control.
2. Oil differential pressure setpoints.
3. Motor protection.
4. High pressure alarm.
5. Loss of refrigerant alarm.
6. Loss of water flow alarm.
7. Freeze protection alarm.
8. Low refrigerant pressure alarm.
9. Auto start/stop switch.
10. Chilled water setpoint adjustment.
11. Anti-recycle timer.
12. Compressor run status.
13. Password protection.
14. Low water temperature safety (freeze protection).
15. Automatic pump down cycle.
16. Limit supply water temperature pull down on start up to 1° per minute.
17. Automatic lead-lag sequence change of compressors.
18. Unload the compressors if the return water is too high.
19. Compressor starts with the controlled cylinders unloaded.
20. Reset of the chilled water temperature.
21. Indicate status of safeties.
22. Non-volatile memory (EPROM) with setpoints retained with battery backup.
23. Automatic high pressure unloader to unload compressor at pressures above 375 psig.
24. Auto restart after power failure.
25. BacNET Interface
26. Alarm Relay
27. Percent of Running Load Amperage

C. Display the following information with Alphanumeric Liquid Crystal Display for outdoor viewing.
1. Supply and Return water temperature.
2. Low water temperature cutout setting.
3. Low ambient temperature cutout setting.
4. Outdoor air temperature.
5. English and Metric data.
6. Suction pressure cutout setting.
7. Each system suction pressure.
8. Each system discharge pressure.
9. Each system oil pressure.

10. Percent of full load motor current.
11. Liquid control range. (2.0 - 20°F above setpoint)
12. Liquid pull down rate sensitivity adjustment.
13. Anti-recycle timer status for each compressor.
12. Compressor starts & operating run hours.
13. Safety shutdown shall be date and time stamped.
14. Compressor run status.
15. Display data in English or metric units.

D. All control functions and information shall be available at the unit control panel or via RS 232 cable and phone modem to personal computer.

E. Chiller shall include a relay board with dry contacts for alarms to notify a Building Automation System of certain events or statues of the chiller.

F. Chiller shall include input for leaving chilled water temperature setpoint based upon a 2-10VDS or 4-20mA signal from a Building Automation System.

G. Chiller shall include input for chiller current limit setpoint based upon a 2-10VDC or 4-20mA signal from a Building Automation System.

2.9 LOW VOLTAGE VARIABLE SPEED DRIVE, UNIT MOUNTED

A. The water chiller shall be furnished with an air cooled variable speed drive (VSD) as shown on the drawings.

B. The VSD will be specifically designed to interface with the water chiller controls and allow for the operating ranges and specific characteristics of the chiller.

C. The VSD efficiency shall be 97% or better at full speed and full load. Fundamental displacement power factor shall be a minimum of 0.96 at all loads.

D. The VSD shall be solid state, microprocessor based pulse-width modulated (PWM) design. The VSD shall be voltage and current regulated. Output power devices shall be IGBTs.

E. Power semi-conductor and capacitor cooling shall be from a liquid or air cooled heatsink.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install system in accordance with manufacturer's instructions.

B. Where the chiller unit is mounted on a grade, a concrete pad shall be provided that is a minimum of 4" high and extends 6" all around the chiller.

C. Align chiller package on steel or concrete foundations.

D. Locate away from overhead restrictions. Maintain side clearances according to manufacturer's recommendations and maintain overhead clearance to allow full elimination of hot air discharge.

E. Install units on vibration isolation pads.

F. Arrange piping for easy dismantling to permit tube cleaning, removing and or repair.

G. Level chiller.

H. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring at cooler and suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation.

3.2 CHILLER MANUFACTURER START-UP/ FIELD SERVICES

A. Provide the services of a factory trained service technician employed full time by the chiller manufacturer to start-up the system. Technicians, as required, shall be factory trained and experienced in the work they perform. (Contractor startup is unacceptable.)

B. The technicians shall utilize comprehensive report forms to document results. Sample forms shall be submitted for review prior to commencing work.

C. Upon completion of the work, the report forms shall be signed by the technicians and their supervisor and included in the final report and Owner's manual.

D. Submit four copies of the final report to the Architect/Engineer for approval within 10 working days of start-up.

E. Follow the manufacturer's start-up procedures.
1. Verify interlocks.
2. Test and verify operation of safety controls.
3. Calibrate controls.
4. Verify microprocessor based control operation.
5. Test, calibrate, and set the chilled water temperature controls.
6. Verify chilled water temperature reset sequence.
7. Verify operation of the integrated control panel.

F. Measure and record the following data:
1. Chilled water entering/leaving temperature.
2. Chilled water flow through the chiller.
3. Suction pressure/condensing pressure.
4. Suction pressure/unloading steps.
5. Air entering/leaving condenser; dry bulb temperature.
6. Outdoor ambient; dry bulb.
7. Motor nameplate voltage; phase and full load amperes.
8. Heater coil in starter (as applicable)
    a. Rating in amperes.
    b. Manufacturer's recommendation.
9. Power reading (voltage and amperes of legs at motor terminals).

G. Test and calibrate the operation of the electronic ground current sensing devices.

H. If the system has been shipped with a holding charge, provide the following:
1. Leak test.
2. Refrigerant pressure test.
3. Evacuate, dehydrate and charge.

I. Verify that accessories are installed and performing the specified functions. Insert certification in Owner's manual.

J. Instruct the Owner's operating personnel. Provide Owner with 8 hours of training prior to substantial completion.

K. Do not operate the equipment for any reason until the factory start-up service has been completed.

L. Provide a printout from the unit microcomputer control system showing the correct operation of all system controls and components.

M. Provide minimum 24-hour history log displaying accuracy of temperature control system in 15-minute intervals and documented number of compressor cycles during the 24-hour period.

END OF SECTION 23 65 28

SECTION 23 73 13 AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install air handling units with casing, fans, coils, filters, and special items.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Air Balance
   2. Ductwork
   3. Controls
   4. Electrical Provisions of Mechanical Work
   5. Air Filtration
   6. Heating and Cooling Coils
   7. Other applicable sections

1.3 PERFORMANCE

A. Unit capacities and characteristics as indicated.
   1. Units must be certified in accordance with ARI Standard 430-66.
   2. UL 1995 certification for safety including electric heat.
   3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

B. Submit fan performance curve for each unit:
   1. Plot fan volume against static pressure, horsepower, and efficiency.
   2. Show point of rating based on static requirements of the system.
   3. Chart of specific sound power level at each octave band center frequency.
   4. For variable volume units, plot fan volume over entire range.

C. Submit for review a unit internal static pressure loss calculation.
   1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
      a. Coils
      b. Dirty filters
      c. Fan and unit system effect
      d. Cabinet and cabinet inlet and outlet
      e. Unit mounted dampers
   2. If a unit mounted outside air pretreatment section without supply fan, “piggyback” is specified:
      a. Provide an itemized static pressure loss as indicated above.
      b. Determine losses for unit configuration, i.e. parallel or series.
      c. Include losses in the primary unit internal static pressure required by configuration.
   3. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

1.6 DELIVERY, STORAGE AND HANDLING

A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier

B. Daikin

C. Temtrol

D. Trane

2.2 MISCELLANEOUS REQUIREMENTS

A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.

B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.

C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.

D. Unit casing panels shall be a minimum of 2” double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042-inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections.

E. Provide full perimeter base rail channel under units constructed of heavy gauge galvanized steel (minimum 10 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening).

F. Fan assembly shall be provided with 1" deflection internally mounted spring vibration isolation under the fan and motor base on units with coils less than 8 sq. ft. and 2" deflection internally mounted spring vibration isolation under the fan and motor base with coils greater than 8 sq. Ft. Units with coils over 35 sq. ft. shall have spring thrust restraints securing the fan housing to the discharge opening panel on units. Fan motor shall be internally mounted. Provide internal flex connection of fan discharge. Maximum acceptable RPM of fan shall not exceed 1000.

G. Provide factory installed removable hinged access doors in the following locations:
   1. Entering side of all coils to allow for cleaning of coils on both sides of unit.
   2. Each side of filter compartment to allow changing of filters from either side.
   3. Each side of motor compartment to allow motor and isolation access.
   4. Each side of condensate drain pan to allow for cleaning and inspection.
   5. Swing the doors against the casing static pressure.

H. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10” minimum downstream of cooling coil.

I. Provide coils with stainless steel casings, end plates, tube supports and top & bottom plates.

J. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.

K. Provide units with a low velocity angled filter section unless otherwise specified.

L. All units shall be provided with adequate space in the cooling coil section to allow for the future installation of UVC Emitters. Cooling coil access door shall be a minimum of 18” wide.

M. Provide all units with a factory provided, mounted and wired junction box of each fan section. Junction box shall allow the electrical contractor to connect power to device without penetrating cabinet. Submittal shall indicate location of junction box.

2.3 DRAW THROUGH AIR HANDLING UNITS SINGLE ZONE

A. Provided with:
   1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
   2. Insulated sheet metal cabinet with removable panels for access to the interior.
   3. Hinged double wall doors with two-step safety handles.

B. Drive assembly:
   1. Sized for 50% overload.

C. Motors and Control:
   1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
   2. Maximum operating point of 70 Hz.
   3. Minimum 90% nominal efficiency at loads of 70%-100%.
   4. Premium efficiency inverter duty
   5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
   6. +/- 10% voltage utilization range to protect against voltage variation.
   5. Cast iron frame and end plate
   6. Forged steel lifting eye
   7. Oversized conduit box with ground lug
   8. Provide with factory installed shaft grounding rings by Aegis
   9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.

D. Supply Fans:
   1. Single width, single inlet, backward curved welded aluminum plenum fan.

2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
3. Tested after being installed in the fan sections.
4. Selected for the design air quantities and pressure of the system.
5. Mounted on a common shaft if multiple wheels.
6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
7. Minimum of Class II fan.

E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.

F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.

G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.

I. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.

J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
1. Condensation on the exterior of the air handling units is not acceptable.

K. Filter section:
1. Constructed with substantial hinges.
2. Neoprene gasketing.
3. Permanent quick release latching devices.
4. Arranged to accommodate the 2" thick filters as specified.

L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.

M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.

N. Provide each fan section with an additional 2” think perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.

O. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

P. Integral Air-to-air, heat exchangers shall be provided as indicated on the schedule and drawings. Exchangers shall be a cross flow, with no moving parts or secondary heat transfer surfaces. Access to all four faces of exchangers shall be provided for cleaning and inspection. Drain pans shall be provided under each supply and exhaust sides of the exchanger, with drain connections extending to the exterior of the unit base. Drain pans shall be stainless steel of the same construction as specified in the unit guide specs.

Q. Sensible and latent heat exchanger core shall contain a combination of polymeric core and plate frame aluminum core. Enthalpy plate exchanger shall be impregnated with a RC134 polymeric desiccant. Polymer shall exchange water by direct vapor transfer using molecular transport with the need of condensation. Core shall be capable of operating in the temperature range from -40F and 140F (-40C and 60C). Enthalpy plate exchanger shall withstand, without more than 10% increase in pressure drop, pressure differential of at least 5” w.g. Enthalpy plate exchanger shall withstand pressure differential of 10” w.g. without permanent deformation. Use of sensible and latent exchanger shall meet ASHRAE 90.1 and 2015 IECC compliance requirements of minimum total effectiveness energy recovery, and fan power limitations.
1. Acceptable Manufacturer
   a. Core Energy Recovery Solutions
   b. Trane
   c. InnergyTech

R. Core shall be provided with a 10-year parts warranty.

2.4 BLOW THROUGH VARIABLE AIR VOLUME AIR HANDLING UNIT – DOUBLE DUCT

A. Provided with:
1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
2. Insulated sheet metal cabinet with removable panels for access to the interior.
3. Hinged double wall doors with two-step safety handles.

B. Drive assembly:
1. Sized for 50% overload.

C. Motors and Control:
1. Totally enclosed, fan cooled, Variable speed, 1750 rpm.
2. Maximum operating point of 70 Hz.
3. Minimum 90% nominal efficiency at loads of 70%-100%.
4. Premium efficiency inverter duty
5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
6. +/- 10% voltage utilization range to protect against voltage variation.
5. Cast iron frame and end plate
6. Forged steel lifting eye
7. Oversized conduit box with ground lug
8. Provide with factory installed shaft grounding rings by Aegis

9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.

D. Supply Fans:
1. Single width, single inlet, backward curved welded aluminum plenum fan.
2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
3. Tested after being installed in the fan sections.
4. Selected for the design air quantities and pressure of the system.
5. Mounted on a common shaft if multiple wheels.
6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
7. Minimum of Class II fan.

E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.

F. Each direct drive fan in a multiple-fan array shall be provided with integral back flow prevention: a backdraft damper that prohibits recirculation of air in the event a fan or multiple fans become disabled. Dampers are tested and rated based on AMCA Standard 500. Dampers to be heavy duty type capable of a maximum back pressure that exceeds the design total static pressure with minimal leakage. The dampers should have a minimal total effect on airflow performance; both pressure drop when open and system effect on the fan. The damper blades and frame shall be extruded aluminum with blade edge seals locked into the blade edge. Adhesive type seals are unacceptable. AHU manufacturer responsible for providing proper spacing upstream of dampers to ensure full, uniform airflow through upstream components. For units where the damper(s) are supplied at the jobsite, the installing contractor shall contract a certified TAB contractor to verify uniform airflow thru upstream components.

G. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

H. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.

I. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
2. Smoke developed rating not higher than 50.

J. Double wall casing construction. Construct interior casing panels with 3 lb. minimum density insulation for acoustical and condensation control.
1. Condensation on the exterior of the air handling units is not acceptable.

K. Filter section:
1. Constructed with substantial hinges.
2. Neoprene gasketing.
3. Permanent quick release latching devices.
4. Arranged to accommodate the 2" thick filters as specified.

L. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide

grommets at all pipe penetrations through cabinets.

M. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.

N. Provide a factory installed equalizing grid in the hot deck where heating coils are not installed.

O. Design the entrance to the hot and cold decks and baffle to preclude wiping action of the air stream.

P. Provide each fan section with an additional 2” think perforated metal inner liner which utilizes fiberglass insulation. Liner shall be installed on all walls and top surface.

Q. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air handling units according to manufacturer's instructions.

B. Provide additional drive packages as required by the Testing and Balancing firm.

C. Air leaks detectable by sound or touch are to be corrected.

D. Air handling units are to be properly supported to prevent flexing, bending, or distorting base rails.

E. All coils are to be cleaned prior to substantial completion if units are used during construction.

F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.

G. Install piping to unit with full size 6-inch-long dirt leg with 1/2" valve at bottom for cleaning.

H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.

I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.

J. Align belts to eliminate wear and vibration of belts.

K. Verify correct drainage of condensate from condensate pan.

L. Verify correct rotation of fan and wiring of motor.

M. Lubricate all greaseable ball bearings with manufacturer’s suggested lubricant.

N. Replace filters as required if units are used during construction.

O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

3.2 IDENTIFICATION

A. Furnish each unit with a durable, deep etched, .025” thick, factory installed aluminum identification plate, permanently mounted with the following information:
1. Unit identification as indicated on Contract Drawings.
2. Serial Number.
3. Model Number.
4. Capacity (CFM) and static pressure.
5. Motor HP.
6. Unit power supply: Volts / PH / Amps.
7. Supply Fan Type.
8. Coil GPM and pressure drop.
9. Sales Order #.
10. Date unit manufactured.

END OF SECTION 23 73 13

SECTION 23 82 16 HEATING AND COOLING COILS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

A. Submit manufacturer's product data sheets and unit capacity information as specified.

B. Submit manufacturer's Installation, Start-Up and Service Instructions.

C. Submit internal wiring diagram.
1. Electrical interlocks. *

1.3 RELATED WORK

A. Division 23 Mechanical.
1. Air Handling Units.
2. Fan Coil Units.
3. Weatherproof Roof Mounted Air Handling Units.
4. Ductwork.
5. Terminal Boxes.

PART 2 - PRODUCTS

2.1 HOT WATER COILS

A. Hot water coils:
1. Constructed of copper tubes and aluminum fins.
2. Designed and circuited for hot water.
a. Maximum temperature 200°F.

B. Where coils are installed in fan powered VAV boxes, unit heaters and other locations where the incoming air is not filtered, the maximum approved fin spacing is 8 fins per inch.

C. Non-trapping circuit design:
1. Working pressure 200 psi
2. Tappings for drain and air vent

D. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil.
1. Positioned to permit accurate pressure readings.

E. Coils shall be constructed in casings as required for installation.

2.2 CHILLED WATER COILS

A. Chilled water coils:
1. Constructed of copper tubes and aluminum fins
2. Designed and circuited for chilled water
3. Minimum of six rows

B. Non-trapping circuit design:
   1. Working pressure 200 psi.
   2. Tappings for drain and air vent.

C. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil. Position to permit accurate pressure readings.

D. Coils shall be constructed in casings as required for installation.

E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.3 DIRECT EXPANSION COOLING COILS

A. DX cooling coils:
   1. Constructed of copper tubes and aluminum fins.
   2. Designed and circuited for use with direct expansion refrigeration.

B. Cooling coil face velocity:
   1. Not of magnitude to cause moisture to be carried off the coil.
   2. Maximum velocity as scheduled.

C. Circuit cooling coil with interlaced tubes so the entire face is active under all modes of unloading. Refer to the schedule on the drawings.

D. Coils shall be constructed in casings as required for installation.

E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

2.4 ELECTRIC HEATERS

A. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.

B. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.

C. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.

D. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.

E. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.

F. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.

G. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes maximum. Furnish

one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.

H. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105°C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION 23 82 16

SECTION 23 82 18 DUCTLESS MINI SPLIT DX UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install mini split system. Complete with a slim silhouette, compact, high wall mounted indoor fan coil section with wireless remote controller and a slim silhouette horizontal discharge outdoor condensing unit. Unit shall be provided with constant speed compressor, pre-charged with R32 or R454B refrigerant. air-cooled condensing units complete with casing, compressor, condenser coil, condenser fan and controls required for a split air conditioning system.

1.2 RELATED WORK

A. Refrigerant Piping.

B. Electrical Provisions of Mechanical Work.

1.3 PERFORMANCE

A. Provide performance as scheduled on drawings, and head pressure control to enable unit to operate in temperatures as low as 20 degrees F. ambient.

1.4 QUALITY ASSURANCE

A. The units shall be tested by a Nationally Recognized Testing Laboratory (NRTL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be rated in accordance with Air-conditioning, Heating, and Refrigeration Institute's (AHRI) Standard 210 and bear the AHRI Certification label.

D. The units shall be manufactured in a facility registered to ISO 9001 Quality assurance Standards and ISO 14001 which are set of standards applying to sustainability and environmental protection set by the International Standard Organization (ISO).

E. A pressure charge of R32 or R545B refrigerant sufficient for up to twenty-five (25) feet of refrigerant tubing shall be provided in the outdoor condensing unit.

F. A dry air holding charge shall be provided in the indoor section.

1.5 WARRANTY

A. The units shall have a manufacturer's parts and defects warranty for a period five (5) years from the date of the original installation. The compressor shall have a warranty of seven (7) years from date of installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carrier (Houston Direct Sales Office)

B. LG

C. Mitsubishi

D. Trane

2.2 INDOOR UNIT GENERAL

A. The indoor shall be factory assembled, wired and run tested. Contained within the unit cabinet shall be all factory wiring, internal piping, electronic control circuit board and fan with fan motor.

B. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, and auto restart after power interruption function, an emergency operation function and a test run switch.

C. Indoor unit and refrigerant pipes shall be charged with dry air before shipment from the factory. All refrigerant piping must be insulated.

2.3 UNIT CABINET

A. The casing shall have a smooth front, top return white finish.

B. Multi directional drain and refrigerant piping offering four (4) directions for refrigerant piping and two (2) directions for draining shall be standard.

C. There shall be a separate installation plate which secures the unit firmly to the wall. Secure mounting of plate and all mounting hardware shall be furnished by and be the responsibility of the installer.

2.4 FAN

A. The indoor unit fan shall be an assembly with a line-flow fan direct driven by a single motor mounted in rubber motor mount.

B. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.

C. Manual adjustable vertical guide vanes shall be provided with the ability to change the airflow from side to side (left to right).

D. An integral, motorized, horizontal air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.

E. The indoor unit fan motor shall operate in four (4) selectable speeds, Powerful, High, Medium, and Low.

2.5 FILTER

A. Return air shall be filtered by means of easily removed, washable, Catechin air filter and an anti-allergy enzyme filter – blue bellows type.

2.6 COIL

A. The indoor unit (evaporator) coil shall be of nonferrous construction with smooth, pre-coated aluminum fins on copper tubing.

B. Tubing shall have inner groves for high efficiency heat exchange.

C. All tube joints shall be brazed with PhosCopper or silver alloy.

D. The coil shall be pressure tested at the factory.

E. A sloped condensate pan and drain with extension hose shall be provided under the coil. Drain connections shall be provided at each end of the drain pan. (Option: A condensate mini-pump shall be provided to provide a means of condensate disposal when a gravity drain is not available.)

2.7 ELECTRICAL

A. The unit shall be equipped with a micro-processor control system directing indoor and outdoor unit coordinated operation.

B. The indoor unit shall not have any supplemental electrical heat elements.

2.8 CONTROL

A. This system shall have a wired wall mounted controller to perform input functions necessary to operate the system. The controller shall consist of the following features:
1. Color Touch Screen Interface
2. Power On / Off Button
3. Mode Selector
4. Temperature Setting
5. Timer Control
6. Fan Speed Select
7. Auto Vane Selector
8. Role based configuration with password protection
9. Integrated BACnet MS/TP connectivity

B. Temperature changes shall be by 1°F increments with a range of 65°F to 87°F.

C. There shall be a 24 hour On / Off timer.

D. The unit shall have an emergency operation mode to allow operation without the remote controller.

E. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wired controller, providing emergency operation and controlling the outdoor unit.

F. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

G. The system shall be capable of automatic restart when power is restored after power interruption.

H. The control system shall control the operation of the air sweep louvers, as well as provide on / off and system / mode function switching.

2.9 OUTDOOR UNIT GENERAL

A. The outdoor unit is designed specifically for use with MS series indoor units. These units are equipped with a circuit board that interfaces to the MS indoor unit circuit board. The outdoor unit shall be completely factory assembled, internally piped and wired. Each unit shall be run tested at the factory.

B. When refrigerant lines are exposed on exterior of building provide “LINE-HIDE” line set cover system.
1. Material, Weather resistant, UV stabilized, ASA/PVC/ABS/Poly/PE
2. Assembly Screws, stainless steel.

2.10 UNIT CABINET

A. The casing shall be fabricated from zinc coated steel, bonderized with an electrostatically applied, thermally bonded, acrylic or polyester powder coating for corrosion protection.

B. Case and mounting feet shall be as follows:
1. The MS-A09WA base shall be of Aluminum-Zinc-Magnesium alloy coated steel, with welded mounting feet.
2. The base for the MS-A12WA shall have a galvanized steel base with welded mounting feet.

C. Cabinet mounting and construction shall be sufficient to withstand 155 MPH wind speed conditions for use in Hurricane condition areas. Mounting, base support, and other installation to meet Hurricane Code Conditions shall be by others.

2.11 FAN

A. The unit shall be furnished with a directive drive propeller type fan, statically and dynamically balanced for smooth and quiet operation.

B. The fan motor shall have inherent protection, be equipped with permanently lubricated bearings. The fan motor shall be mounted and isolated for quiet operation.

C. The fan shall be provided with a raised guard to prevent contact with moving parts.

D. The outdoor unit shall have horizontal discharge airflow.

2.12 COMPRESSOR

A. The compressor shall be a high performance, hermetic, rolling piston, rotary type.

B. Compressor shall be mounted using rubber isolating bushings to avoid the transmission of vibration.

C. Compressor shall be protected by an automatic over current relay and a thermal overload switch.

2.13 OPERATION

A. The outdoor unit shall have an accumulator.

B. The outdoor unit must have the ability to operate with a maximum height difference of 35

feet between indoor and outdoor units.

C. The unit shall have a maximum refrigerant tubing length of 65 feet between indoor and outdoor units without the need for line size changes, traps or additional oil. All refrigerant lines must be insulated.

D. The unit shall be pre-charged for a maximum of 25 feet of refrigerant tubing.

2.14 ELECTRICAL

A. The electrical power of the system shall be 115 volts, 1 phase, 60 hertz. The unit shall be capable of satisfactory operation within voltage limits of 103 volts to 127 volts.

B. The outdoor unit shall be controlled by the microprocessor located in the indoor unit. The control voltage between the indoor unit and the outdoor unit shall be 115 volts, AC.

2.15 A2L REFRIGERANT LEAK DISSIPATION SYSTEM

A. Leak dissipation system shall consist of control board and A2L sensor certified to UL 60335-2-40, integrated with unit controller.

B. System shall be designed for the life of the unit.

C. Dissipation system shall be automatic, ship pre-wired, and require no additional field connections to function.

D. Refrigerant leak sensor shall be installed in UL-certified location and orientation. Sensor shall be self-correcting and resettable. Single use refrigerant leak sensor shall not be permitted.

E. Factory-installed dissipation system shall use onboard microprocessor and include:
1. Automatic leak detection and dissipation algorithm.
2. Automatic reset after a dissipation event has occurred.
3. Onboard LED with flash code to indicate current unit status and hardware failures.
4. Depressible “Test” button to allow for a system test and recall/reset of leak detection history.
5. 24-v dry contact alarm terminal on dissipation control board to allow for external notification of leak detection.
6. Ability to notify BAS system of dissipation event via readable alarm point unit controller.
7. Recallable dissipation alarm history on unit controller.

F. Dissipation control board shall be accessible via normal maintenance locations and LED shall be visible.

G. Dissipation system shall “Fail Safe” per UL requirements.

H. Dissipation shall allow smoke and building fire systems to override in case of event.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mount condensing units on 4" foundation pads and pipe as shown on Drawings or as recommended by the equipment manufacturer. Install refrigerant filter dryer and sight

indicating glass.

B. Install units on vibration isolation pads.

3.2 CONTROL WIRING

A. BMCS contractor shall provide and install all low voltage control wiring associated with the new split systems. This includes but not limited to wiring to temperature sensors, low voltage wiring between indoor and outdoor units. Installation shall be in accordance with manufacturer’s installation requirements.

3.3 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer’s recommendations.

B. The wired controller shall be shipped inside the carton with the indoor unit and able to withstand 105°F storage temperatures and 95% relative humidity without adverse effect.

3.4 START-UP

A. Follow the manufacturer's start-up procedures.

B. Provide flexible elastomeric rubber closed cell insulation to prevent condensation from occurring op suction piping. After completion of successful start-up, installing contractor shall seal all openings in insulation and apply a protective aluminum sheetmetal jacket over insulation exposed on exterior of building.

END OF SECTION 23 82 18

SECTION 23 82 19 FAN COIL UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Floor mounted decorative cabinet fan/coil units, horizontal fan/coil units for concealed installation and horizontal exposed ceiling mounted fan/coil units with decorative cabinet.

1.2 RELATED WORK

A. Division 23 Mechanical
   1. Air Balance
   2. Controls
   3. Electrical Provisions of Mechanical Work
   4. Ductwork
   5. Air filtration

1.3 REFERENCES

A. ANSI/AHRI 410 - force circulation air cooling and air heating coils

B. National Electrical Code

1.4 SUBMITTALS

A. Submit manufacturer's dimensioned product data sheets.
   1. Show location of filter access doors.

B. Submit fan performance curve for each unit:
   1. Plot fan volume against static pressure, horsepower and efficiency.
   2. Show point of rating based on static requirements of the system.

C. Submit the fan performance plot at each motor speed position with consideration for the reduced internal static.

D. Submit a chart of specific sound power level at each octave band center frequency.

E. Submit manufacturer's certified heating and cooling coil capacity data.

F. Submit filter manufacturer's product data sheets and capacity information.

G. Submit manufacturer's data on housing insulation material.

1.5 CAPACITY

A. Refer to equipment schedule.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. AAON

B. Carrier

C. Envirotec

D. Trane

2.2 COMPONENTS

A. Fan section

B. V-belt drive assembly, or,

C. Multi-speed direct connected motor

D. Filter section

E. Coil section

F. Insulated sheet metal cabinet with removable panels for access to the interior

G. Motor and drive inside the cabinet

2.3 FAN SECTION

A. Locate the motor and drive assembly inside the cabinet.

B. Size each v-belt drive for 50% overload.
1. Adjustable pitch motor pulley
2. Provide built-in motor protection
3. Belt adjustment means

C. Provide multi-speed direct connected fan motor with built-in motor protection.
1. Three-speed windings
2. Factory wired to a junction box with provisions for motor speed change, mounted on the box
3. Resiliently mounted

D. Select the fan motor so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate amperage rating.

E. Supply Fans:
1. Double width, double inlet, forward curve blade
2. Statically and dynamically balanced
3. Tested after being installed in the fan section
4. Selected for the design air quantities and static pressure of the system
5. Mounted on a common shaft if multiple wheels

F. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.

G. Fan Bearings:
1. Permanently lubricated
2. Self-aligning

2.4 DECORATIVE HOUSING AND PLENUM

A. Where units are exposed to view in occupied spaces and where scheduled, construct cabinets of cold rolled steel, bonderized and coated with baked enamel finish.

B. Access panels shall have position locking fasteners for easy removal.
1. Plated screws with captive nuts
2. Hinged if too large for one man operation

2.5 UNIT HOUSING

A. Construct the unit of galvanized steel sheets, and formed members.
1. Provide structure to brace the assembly for the pressure of the system.

B. Bolt housing components together with neoprene gasketed airtight joints.

C. Internally insulate the entire unit with neoprene coated, 1-1/2 lb. density glass fiber insulation, applied to internal surfaces with adhesive and weld pins. Coat exposed edges of insulation with adhesive.

D. Insulation, vapor barriers, facings and adhesives:
1. Flame spread not higher than 25
2. Smoke developed rating not higher than 50

E. Condensation on the exterior of the unit is not approved.

F. Provide a duct flange on four sides of the return air inlet and supply air outlet of the unit.
1. Sized to permit connection of the flexible connection to the ductwork
2. Extend beyond the primary drain pan
3. Minimum dimension 2"

G. Provide insulated, removable panels for access to the interior.
1. Plated captive screws and nuts
2. Neoprene gaskets

2.6 CONDENSATE DRAIN PANS

A. IAQ style drain pans shall be provided under all coils.
1. Pitch to drain connection
2. Fabricated from 16 gauge 304 stainless steel
3. Triple pitched for complete drainage with no standing water
4. Insulated to prevent condensation
5. Welded corners
6. Stainless drain connection

2.7 COILS

A. Reference Schedule and Specification Section 23 82 16.

2.8 FILTER SECTION

A. Locate behind access doors.
1. Construct with substantial hinges
2. Neoprene gaskets
3. Permanent quick-release latching devices

B. Arranged to accommodate the 1" thick filters as specified.
   1. Single section filter

C. Provide full length tracks to support the filter.

2.9 A2L REFRIGERANT LEAK DISSIPATION SYSTEM - DX FAN COIL UNITS

A. Leak dissipation system shall consist of control board and A2L sensor certified to UL 60335-2-40, integrated with unit controller.

B. System shall be designed for the life of the unit.

C. Dissipation system shall be automatic, ship pre-wired, and require no additional field connections to function.

D. Refrigerant leak sensor shall be installed in UL-certified location and orientation. Sensor shall be self-correcting and resettable. Single use refrigerant leak sensor shall not be permitted.

E. Factory-installed dissipation system shall use onboard microprocessor and include:
   1. Automatic leak detection and dissipation algorithm.
   2. Automatic reset after a dissipation event has occurred.
   3. Onboard LED with flash code to indicate current unit status and hardware failures.
   4. Depressible “Test” button to allow for a system test and recall/reset of leak detection history.
   5. 24-v dry contact alarm terminal on dissipation control board to allow for external notification of leak detection.
   6. Ability to notify BAS system of dissipation event via readable alarm point unit controller.
   7. Recallable dissipation alarm history on unit controller.

F. Dissipation control board shall be accessible via normal maintenance locations and LED shall be visible.

G. Dissipation system shall “Fail Safe” per UL requirements.

H. Dissipation shall allow smoke and building fire systems to override in case of event.

PART 3 - EXECUTION

3.1 SPARE PARTS

A. Provide the following spare parts and material to the Owner for use after the warranty period.
   1. One spare fan motor for each size of fan motor on the project
   2. One spare set of filters or filter media for each fan coil unit on the project

3.2 ELECTRICAL REQUIREMENTS

A. Bring electrical connections to a common junction box.

3.3 STORAGE

A. Storage and shipping in accordance with manufacturer's recommendations.

3.4 INSTALLATION

A. Install unit so motor connections and filters are accessible.

END OF SECTION 23 82 19

SECTION 23 82 39 ELECTRIC UNIT HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide and install electric unit heaters complete with heating element, propeller mounting brackets and other options as specified.

1.2 RELATED WORK

A. Division 23 - Mechanical.
   1. Electrical Provisions of Mechanical Work.
   2. Ductwork.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Chromalox

B. Markel

C. Modine

D. Reznor

E. Trane

2.2 COMPONENTS

A. Casing:
   1. Construct casing of sheetmetal with a structural frame.
   2. Enamel or lacquer finish to manufacturers standard.

B. Electric Heating Elements:
   1. Shall bear the UL label.
   2. Corrosion resistant materials.
   3. Heating coil of 80-20 nickel-chrome wire.

C. Components:
   1. Fused control circuits
   2. Contactors in accordance with the staging requiremens
   3. Control power transformer
   4. Control voltage 120

D. Louvers:
   1. Adjustable vertical and horizontal louvers for air discharge.

E. Mounting brackets:
   1. As indicated

2.3 CONTROLS

A. Automatic controls:
   1. Factory mounted
   2. Prewired to the junction box
   3. Unit mounted thermostats 24-volt low voltage

B. Safety Controls:
   1. A primary and secondary thermal cut-off to de-energize each circuit.
   2. Manual reset high limit
   3. Automatic reset thermal protection

2.4 FAN

A. Propeller blade fan:
   1. Construct the fan of aluminum or other corrosion-resistant material.
   2. Statically and dynamically balanced
   3. Substantial fan guard

2.5 MOTOR

A. Totally enclosed ball bearing motor:
   1. Permanently lubricated bearings
   2. 120 volt, single phase, 60 cycle motor
   3. Sized to operate the fan at the required capacity

2.6 ELECTRICAL

A. Single point connection:
   1. Factory wiring
   2. Only direct line supply and thermostat field connections
   3. Terminal blocks for line voltage wiring
   4. Wiring diagram permanently attached
   5. Balance phases

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish units with suitable connections for mounting as shown or as otherwise approved.

B. Provide start-up to ensure correct operation of unit.

C. Adjust discharge louvers to control direction of air flow.

END OF SECTION 23 82 39

SECTION 23 82 41 ELECTRIC DUCT HEATERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install electric duct heaters as indicated on drawings.

1.2 RELATED WORK

A. Ductwork.

B. Electrical Provisions of Mechanical Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Brasch

B. Greenheck

C. Indeeco

C. Redd-i, Inc.

2.2 MATERIALS

A. Heater. Provide duct type electric heater. Capacity shall be as scheduled on the drawings. Heater shall have 80% nickel, 20% chromium, open resistance coils insulated by floating ceramic bushings, and be supported in an aluminum steel frame.

B. Casings. Heater casing shall be of the slip-in type for installation through a rectangular opening in the side of the duct.

C. Bushings. Ceramic bushings shall be recessed into embossed openings and staked into supporting brackets spaced 3-1/2" maximum center to center.

D. Coil. Coil shall be machine-crimped into threaded terminals and insulated with phenolic bushings. All terminal hardware shall be stainless steel.

E. UL Listing. Heater shall be listed by the Underwriters Laboratories for zero clearance to combustible surfaces and for use with central air conditioners.

F. Primary Protection. For primary protection, furnish a disk-type automatic reset thermal cutout for pilot duty only.

G. Secondary Protection. For secondary protection, load-carrying manual reset thermal cutouts shall be wired in series with each heater circuit. Cutouts shall be rated at 480 volts minimum.

H. Feeder. Voltage, phase and number of heating stages shall be furnished in accordance with duct heater schedule. Three-phase heaters shall have single-phase circuits for operation from a 3-phase, 4-wire power source. Circuits shall be rated at 48 amperes

maximum. Furnish one set of line terminals to feed all circuits. Heater shall be tested dielectrically at 2000 volts before shipment. Field-installed conductors feeding the heater shall be sized for 125% of the connected load.

I. Built-in Features. Built-in components shall be factory wired to terminal blocks for field connection. All internal wiring shall be insulated for 105□C. Built-in magnetic contactors shall disconnect all ungrounded conductors to each circuit. Furnish heaters with an air flow switch that will not allow heaters to energize without proof of air flow. Built-in transformer shall be dry industrial type, sized to carry full contactor holding coil load. Primary windings shall be fused at the factory. Built-in fuses shall be factory wired to each circuit to protect all underground conductors. Type NON or NOS fuses to be factory installed in phenolic fuse blocks. Built-in disconnect switch to be snap action, industrial type. Provide a door interlock mechanism to prevent hinged terminal box cover from being opened when the switch is on. Switch shall be unfused.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide support rails in bottom of duct for duct heaters over 36" long. Install in accordance with manufacturer's recommendations. Before ordering duct heaters, coordinate with the structural drawings before locating the duct heater control boxes.

END OF SECTION 23 82 41

SECTION 26 01 05 ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of LED chip boards, Light Engines
12. Schedule of Drivers
13. Schedule of Fuses
14. Other required operating and maintenance information that are complete.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the completed manuals in final electronic form to the Architect / Engineer.
1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.

D. The Architect / Engineer shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.

F. Complete electronic manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.

B. Minimum ring size: 1"; Maximum ring size: 3".

C. When multiple binders are used, correlate the data into related groupings.

D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11"
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable
   c. Identity of general subject matter covered in the manual.
6. Binder as specified

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer
      2) Maintenance contractor as appropriate
      3) Identify area of responsibility of each.
      4) Local source of supply for parts and replacement
   d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product.
   b. Annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:

1) Relations of component parts of equipment and systems
2) Control and flow diagrams

b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
c. Do not use Project Record Documents as maintenance drawings.

4. Written text as required to supplement product data for the particular installation:
   a. Organize in consistent format under separate headings for different procedures.
   b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure
      2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts:
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine / normal operating instructions
      2) Regulation, control, stopping, shut down and emergency instructions
      3) Summer and winter operating instructions
      4) Special operating instructions
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting
      3) Disassembly, repair and reassembly
      4) Alignment, adjusting and checking
      5) Routine service based on operating hours
   d. Servicing and lubrication schedule
      1) List of lubricants required
   e. Manufacturer's printed operating and maintenance instructions.
   f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
      1) Electrical
      2) Controls
      3) Communications
   g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      1) Predicted life of part subject to wear
      2) Items recommended to be stocked as spare parts
   h. Schedule of fuses
   i. Complete equipment field accessible internal wiring diagrams
   j. Schedule of lamps
   k. Schedule of ballasts
   l. Each Contractor's coordination drawings
   m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage

n. Other data as required under pertinent sections of the specifications

2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 26.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION 26 01 05

SECTION 26 05 00 ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.

B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.

B. Electrical work shall comply with applicable inspection services:
1. Underwriters Laboratories
2. National Fire Protection Association
3. State Health Department
4. Local Municipal Building Inspection Department adopted codes with amendments
5. National Electrical Code with local amendments
6. State Regulatory Agencies
7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
9. International Energy Conservation Code
10. National Electrical Safety Code

C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.

B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or another recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
1. Underwriters Laboratories, Inc. (UL)
2. Factory Mutual Research Corp. (FMRC) (also referred to as “Factory Mutual Global,” or “FM Global”)
3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
4. Canadian Standards Association (CSA)
5. A complete listing of acceptable NRTLs is published on the OSHA website at http://www.osha.gov/dts/otpca/nrtl/.

C. Where material and equipment are not labeled, listed, or recognized by any NRTL, provide a manufacturer’s Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.

D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner’s AHJ. This *National Electrical Code*® requirement is re-stated for emphasis.

E. Codes and Standards applicable to this Division:
1. ANSI – American National Standards Institute
   a. ANSI Z535.1, Safety Colors
   b. ANSI Z535.2, Environmental and Facility Safety Signs
   c. ANSI Z535.3, Criteria for Safety Symbols
   d. ANSI Z535.4, Product Safety Signs and Labels
2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
   a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for Low Rise Residential Buildings [ANSI, IESNA]*
3. ASTM – American Society for Testing and Materials
4. CBM – Certified Ballast Manufacturers
5. ICC – International Code Council
   a. International Building Code® (IBC)
   b. International Existing Building Code® (IEBC)
6. ICEA – Insulated Cable Engineers Association
   a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
7. IEEE® - Institute of Electronics and Electrical Engineers
   a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
   b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plans* (“Red Book”)

c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* (“Green Book”)
d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* (“Gray Book”)
e. IEEE Std 242 ™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* (“Buff Book”)
f. IEEE Std 315 ™, *Graphic Symbols for Electrical and Electronics Diagrams*
g. IEEE Std 399 ™, *Recommended Practice for Power Systems Analysis* (“Brown Book”)
h. IEEE Std 446 ™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* (“Orange Book”)
i. IEE Std 493 ™, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* (“Gold Book”)
j. IEEE Std 519 ™, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*
k. IEEE Std 739 ™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities* (“Bronze Book”)
l. IEEE Std 902 ™, *Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems* (“Yellow Book”)
m. IEEE Std 1015 ™, *Recommended Practice Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems* (“Blue Book”)
n. IEEE Std 11oo ™, *Recommended Practice for Powering and Grounding Electronic Equipment* (“Emerald Book”)
o. IEEE Std 1584 ™, *Guide for Performing Arc-Flash Hazard Calculations*

8. IESNA – Illuminating Engineering Society of North America
   a. IESNA *Lighting Handbook*, Ninth Edition
   b. IESNA RP-1, *American National Standard Practice for Office Lighting*
   c. IESNA RP-7, *American National Standard Practice for Lighting Industrial Facilities*
9. NECA – National Electrical Contractors Association:
   a. NECA 1, *Good Workmanship in Electrical Construction* [ANSI]
   b. NECA 90, *Recommended Practice for Commissioning Building Electrical Systems* [ANSI]
   c. NECA 100, *Symbols for Electrical Construction Drawings* [ANSI]
   d. NECA 101, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)* [ANSI]
   e. NECA 104, *Recommended Practice for Installing Aluminum Building Wire and Cable* [ANSI]
   f. NECA / NEMA 105, *Recommended Practice for Installing Metal Cable Tray Systems* [ANSI]
   g. NECA 111, *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)* [ANSI]
   h. NECA / NACNA 120, *Standard for Installing Armored Cable (Type AC) and Metal-Clad Cable (Type MC)* [ANSI]
   i. NECA 202, *Recommended Practice for Installing and Maintaining Industrial Heat Tracing Systems* [ANSI]
   j. NECA 230, *Standard for Selecting, Installing and Maintaining Electric Motors and Motor Controllers* [ANSI]
   k. NECA 331, *Standard for Building and Service Entrance Grounding and Bonding*
   l. NECA 400, *Standard for Installing and Maintaining Switchboards* [ANSI]

m. NECA 402, *Standard for Installing and Maintaining Motor Control Centers* [ANSI]
n. NECA / EGSA 404, *Standard for Installing Generator Sets* [ANSI]
o. NECA 407, *Recommended Practice for Installing and Maintaining Panelboards* [ANSI]
p. NECA 408, *Recommended Practice for Installing and Maintaining Busways* [ANSI]
q. NECA 409, *Recommended Practice for Installing and Maintaining Dry-Type Transformers* [ANSI]
r. NECA 410, *Recommended Practice for Installing and Maintaining Liquid-Filled Transformers* [ANSI]
s. NECA 411, *Recommended Practice for Installing and Maintaining Uninterruptible Power Supplied (UPS)* (ANSI]
t. NECA 420, *Standard for Fuse Applications* [ANSI]
u. NECA 430, *Standard for Installing Medium-Voltage Metal-Clad Switchgear* [ANSI]
v. NECA / IESNA 500, *Recommended Practice for Installing Indoor Lighting Systems* [ANSI]
w. NECA / IESNA 501, *Recommended Practice for Installing Exterior Lighting Systems* [ANSI]
x. NECA / IESNA 502, *Recommended Practice for Installing Industrial Lighting Systems* [ANSI]
y. NECA / MACSCB 600, *Recommended Practice for Installing and Maintaining Medium-Voltage Cable* [ANSI]
z. NECA / NEMA 605, *Installing Underground Nonmetallic Utility Duct* [ANSI]

10. NEMA – National Electrical Manufacturers Association
11. NETA – International Electrical Testing Association, Inc.:
    a. NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    b. NETA MTS, *Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*
    c. NETA ETT, *Standard for Certification of Electrical Testing Technicians* [ANSI]
12. NFPA – National Fire Protection Association:
    a. NFPA 20®, *Standard for the Installation of Stationary Pumps for Fire Protection®*
    b. NFPA 70 ™, *National Electrical Code® (NEC®)*
    c. NFPA 70E, *Standard for Electrical Safety in the Workplace.*
    d. NFPA 101®, Life Safety Code®
    e. NFPA 110, *Standard for Emergency and Standby Power Systems*
    f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
    g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
    h. All other NFPA codes and standards except NFPA 5000
13. OSHA – Occupational Safety and Health Administration
14. IECC – International Energy Conservation Code
15. ISO – International Organization for Standardization
16. State and Local Energy Conservation Code
17. Applicable County and Municipal Codes

1.5 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.

C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.

D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

1.6 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducibles and prints is a condition of final acceptance.
   1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
   2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
   3. Three sets of blue-line prints of each contract as-built drawing.
   4. Three sets of pdf prints of each contract as-built drawing on CD.

C. As-Built Drawings should indicate the following information as a minimum:
   1. Indicate all addendum changes to documents.

2. Remove Engineer's Seal, name, address, and logo from drawings.
3. Mark documents RECORD DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY:
5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
6. Indicate exact location of all underground electrical raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all electrical equipment in and outside of the building.
11. Exact location of all outdoor lighting poles and equipment.
12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
14. Cloud all changes.
15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.

1.7 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.8 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
   1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.

2. The responsibility for alignment of motor and driven equipment is specified in the related division.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.14 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:

1. Obtained from utility maps and other substantially reliable sources.
2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.15 OPERATING TESTS

A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.16 WARRANTIES

A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.

B. Manufacturer’s warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.

C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.17 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.18 TEMPORARY FACILITIES

A. General: Refer to Division 1 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 IDENTIFICATION OF EQUIPMENT

A. Identification of Equipment:

1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.
2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote generator transfer deices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.
   a. Utility Power: White letters on black background
      Generator Power (White letters on red background
      UPS Power: White letters on blue background
      Load Bank Circuits: White letters on green background
      Solar or Wind Power Generation: White on orange background
   b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and ¼-inch letters indicating source circuit designation, (i.e.: “PANEL HA –fed from MDP-6 located in Mech. Rm. 100”). The words “fed from” and “located” shall be included in the labeling.
      Example: Panel HA
      Fed From MSB
      Located Main Elec. RM 100
      Example: Disconnect for Panel LK
      Location: Kitchen
      Fed From Transformer TLK
      Located Main Elec. RM 100
   c. Each switchboard, distribution panel, transfer switch, generator transfer device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in ¼-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
   d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel “HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100”)
   e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.

f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e., C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1 West Parking Lot Pole Lights Fed From Panel HA-2,4,6 Located Main Elec. Rm. 100 Control Circuit-Panel LA 42 Located Main Elec. Rm. 100 Controlled-BMCS	Receptacle Contactor C2 Table Recpts Lab Rm 100 Fed From Panel LA-2,4,6,8 Located Mech. Rm. 110 Control Circuit-Panel LA-42 Controlled-Emer Shut Off Mushroom Switch Rm 101
GTD Example	
Exterior lighting wall packs / north soffit / west metal canopy Fed from Panels EHA-2 located in Elec. RM 105 and HA-1 via Lighting Contactor controlled by BMCS located in Elec. RM 200.	

g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A

h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.

i. Panel names for 277/480v shall start with the letter “H” and 120/208v, 120/240v shall start with the letter “L”. No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner’s electrical representative. Panel names shall not include the letter “I”. Transformer names shall start with the letter “T” followed by the panel name it serves, i.e., TLA.

j. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.

Main Service ATS Example ATS-1	Wall Mounted Lighting ATS Example ATS
Emer Power-Emer Generator Located Chiller Yard Normal Power-MSB Located-Mech Rm 100 Serves Panel EHA Located-Mech Rm 100	Exterior Wall Packs/Soffit Lights North/West Metal Canopy Lights Fed from EHA-2 Located Mech Rm 200 Fed From HB-4 Located Mech Rm 150

k. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.

l. Switchgear, switchboards, panelboards, motor control centers, or service

equipment available fault current labeling: Provide a 2x3 inch permanently affixed (notice) label with white lettering on contrasting blue background permanently affixed to the equipment prior to energizing the equipment. The label shall include the date of installation and the date of calculation and comply with ANSI Z535.4 current standards design and durability. The date of calculation shall be the date indicated by the Engineer of Record's seal on the Construction Documents. Example:

AVAILABLE FAULT CURRENT: ##, ### AMPS
DATE OF INSTALLATION: MM/DD/YY
DATE OF CALCULATION: MM/DD/YY

3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as "corridors". Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect's final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.
4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner's motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.

B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information at each location, mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.

E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard / switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red for 50 volts or above electrical, or orange for communications and control with suitable warning legend describing buried electrical lines; telephone lines and data lines per APWA recommendations. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.

G. Lighting Controls and Equipment: Provide self-adhesive machine typed tape labels with ¼" high white letters on ½" tall black background for digital lighting modules as "DLM". Modules or relays located above ceiling: adhere label to bottom of ceiling T-grid below relay location. Modules or relays located in mechanical or electrical rooms or other areas other than above ceiling: Adhere label to the cover of the module or relay and identify the area they control as "MAIN GYM", "BAND HALL", or "CORRIDOR 100", etc. Remote lighting control switches or push-button stations located remotely from the area they control: Adhere label to device face plate, not obstructing screw fasteners, and intuitively identify function such as "GYM LTG LOW-HIGH" or "CAFE LTG DIM", etc.

3.2 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.3 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
   1. Provide the training during regular working day.
   2. The instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
   3. Refer to other specification sections for additional training and commissioning requirements.

B. Time to be allocated for instructions.
   1. Minimum of 20 hours dedicated instructor time.
   2. 4 hours on each of 5 days
   3. Additional instruction time for specific systems as specified in other Sections.

C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.4 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.5 HOUSEKEEPING PADS

A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.

B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.

C. Concrete pads:
1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors or match existing if indicated on the drawings to extend existing pads, or in other sections of the specifications.
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.6 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.

1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.8 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer’s minimum circuit conductors, at no additional cost to the Owner.
4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity entering the equipment enclosures shall not exceed the equipment manufacturer’s maximum recommendations.

3.10 FAULT CURRENT AND ARC FLASH STUDY FOR OVERCURRENT DEVICE COORDINATION

A. Contractor shall provide a coordination study, fault current analysis, and Arc-Flash study report for new electrical distribution equipment downstream to the last new overcurrent device in each feeder or branch circuit, conducted and prepared by the switchgear manufacturer. The coordination study and fault current analysis shall include the manufacturer's recommendations for all adjustable overcurrent devices specified or provided. Study does not require inclusion of existing switchgear, except it shall include existing or new overcurrent devices in existing switchgear serving new switchgear. Contractor shall submit the report results prior to submitting switchgear submittals to allow changes or modifications to equipment selection.

B. Contractor shall adjust all overcurrent device settings based on manufacturer's recommendations, or as directed by Owner / Architect at no additional cost to Owner. Settings for GFI shall be set at maximum as permitted by the NEC.

C. Arc-Flash & Shock-Hazard Warning Labels: Provide arc-flash and shock hazard-warning labels that comply with ANSI Z535.4 on switchgear, switchboards, transformers, motor control centers, panelboards, motor controllers, safety switches, industrial control panels and other equipment that is likely to require examination, adjustment, servicing, or maintenance while energized. Locate the marking to be clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment. On renovation projects, install arc-flash warning labels on existing equipment where lock-out / tag-out will be required for the renovation work. Provide the information listed below on each label. Specify that arc-flash warning label information be produced by the electrical equipment manufacturer or supplier as a part of the final power system studies to be submitted by the Contractor in accordance with the electrical acceptance testing.
   1. Note: In addition to the final arc-flash analysis, the final power system studies include load flow and fault-current calculations, and an overcurrent protective device (OCPD) coordination study based on the actual equipment to be installed for the project.

D. Information to be determined and applied to electrical equipment:
   1. Arc-Flash Protection Boundary
   2. Arc-Flash incident energy calculated in accordance with IEEE Std 15841 ™
   3. Working distance calculated in accordance with IEEE Std 1584a ™
   4. NFPA 70E Hazard / Risk Category Number or the appropriate personal protective equipment (PPE) for operations with doors closed and covers on.
      a. Typical operations include operating circuit breakers, fused switches, and meter selector switches.
   5. System phase-to-phase voltage
   6. Condition(s) when a shock hazard exists (e.g., "With cover off")
   7. Limited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   8. Restricted Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   9. Prohibited Approach Boundary as determined from NFPA 70E, Table 130.2(C)
   10. Unique equipment designation or code (described under "Component Identification"
   11. Class for insulating gloves based on system voltage (e.g., Class 00 up to 500V)
   12. Voltage rating for insulated or insulating tools based on system voltage (e.g., 1000V)
   13. Date that the hazard analysis was performed.
   14. "Served from" circuit directory information including the serving equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.
   15. If applicable, the "serves" circuit directory information including the served equipment designation, location (e.g., room number), circuit number, and circuit voltage / number of phases / number of wires.

16. An abbreviated warning label may be used where it has been determined that no dangerous arc-flash hazard exists in accordance with IEEE 1584a ™, paragraph 9.2.3.
17. Use a “DANGER” label where the calculated arc-flash incident energy exceeds 40 cal/cm.

E. Submittals: Submit four copies of coordination study and certified fault current study results to the Architect for review.

3.11 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone equipment terminal location.
2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice / video / communications equipment location / cable TV head end equipment, or security equipment location.

3.12 TESTING

A. The contractors for the various sub-systems shall submit proposed testing procedures for their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.

B. The project will not be declared substantially complete until the following has taken place.
1. The “As-Built” drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner’s Construction Representative.
2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
   a. Occupancy Sensor and Lighting Controls
   b. Surge protective device equipment
   c. Overcurrent devices
   d. Motor Controllers
   e. Emergency Lighting

3.13 LOAD BALANCING

A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, “Motor Tip Sheet #7” dated September 2005 available for download to PDF format at no charge at: http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate_voltage_un_balanced_motor-systemts7.pdf

END OF SECTION 26 05 00

SECTION 26 05 08 **TELECOMMUNICATIONS, CATV, VOICE, DATA, VIDEO UTILITY COORDINATION AND SERVICE ENTRANCE**

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General: Provide infrastructure, conduit, ductbanks and pathways from public street right-of-way to building for telecommunications, CATV, voice, data, and video.

B. Utility Company Data: Obtain from utility company information and installation standards for telecommunication, CATV, voice, data, video service installation.

C. Responsibilities: Determine what equipment and labor is provided by utility company and what equipment and labor is required of this Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Utility Data: Ensure that utility company service data is accurate and verified.

2.2 UTILITY INFRASTRUCTURE

A. General: Division 26 shall make provisions for utilities as required by utility company, including, but not limited to permanent or removable/lockable vehicular barriers, grounding rods, grounding conductors, sleeves, conduits, concrete ductbanks, pull boxes and manholes.

B. The utility company shall provide cabling and connections to the Owner’s demarcation point of service.

C. Coordinate communications pathway with Division 27.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Standards: The installation of the service entrance provisions shall comply with the published standards and requirements of the utility company, the utility company’s specific construction requirements for this project, and with requirements of this Division.

B. Correction: Any failure to meet the standards and requirements shall be corrected to the satisfaction of the utility company and Owner without any additional cost to the Owner.

C. Contractor shall provide all construction materials and labor that the utility company determines to be the responsibility of the customer, at no additional cost to the Owner.

D. The materials and labor required by the utility company that shall be provided by the contractor includes, but is not limited to permanent or removable / lockable vehicular barriers, grounding rods, grounding conductors, sleeves, concrete pads, concrete reinforced ductbanks, conduits, racks and metering enclosures, pull boxes and manholes.

E. Utility pole and utility conduits and/or ductbank locations shall be staked and surveyed prior to utility installations by the Contractor to verify their proper placement is within the Owner’s property

and respective utility easements. Contractor shall verify by survey that the pole, conduit and ductbank location and easements do not interfere with existing easements, right-of-ways, or other restricted properties. Conflicts with existing easements and restrictions shall be brought to the attention of the Architect prior to construction.

F. Contractor shall initiate contact with the utility provider and Owner within 14 days of Notice to Proceed to ensure all utilities will be available to the site. Any delays resulting from lack of this coordination shall be the responsibility of the Contractor.

END OF SECTION 26 05 08

SECTION 26 05 09 ELECTRIC UTILITY COORDINATION AND SERVICE ENTRANCE

PART 1 - GENERAL

1.1 WORK INCLUDED

A. General: Electrical service shall be provided by local utility company.

B. Power Company Data: Obtain from utility company information and installation standards for electrical service installation.

C. Responsibilities: Determine what equipment and labor is provided by utility company and what equipment and labor is required of this Contractor.

PART 2 - PRODUCTS

2.1 GENERAL

A. Service Data: Ensure that utility company service data is accurate and verified.

2.2 PRIMARY SERVICE

A. General: Division 26 shall provide primary service conduit, concrete transformer pads, concrete duct bank, utility service and metering equipment enclosures, manholes, and pull boxes as required and as specified.

B. Utility company shall provide primary cables, splices, utility metering instruments, terminations, and primary underground and overhead service conductors.

2.3 TRANSFORMERS AND SWITCHGEAR

A. General: Division 26 shall make provisions for service as required by utility company, including, but not limited to permanent or removable/lockable vehicular barriers, grounding rods, grounding conductors, and sleeves.

B. The utility company shall provide service transformers, primary switchgear, primary protective relaying, and connections to the customer service.

2.4 SECONDARY SERVICE CONDUCTORS

A. General: Division 26 shall provide secondary service entrance conductors, conduit and concrete duct bank.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Standards: The installation of the service entrance provisions shall comply with the published standards and requirements of the utility company, the utility company's specific construction requirements for this project, and with requirements of this Division.

B. Correction: Any failure to meet the standards and requirements shall be corrected to the satisfaction of the utility company and Owner without any additional cost to the Owner.

C. Contractor shall provide all construction materials and labor that the utility company determines to be the responsibility of the customer, at no additional cost to the Owner.

D. The materials and labor required by the for a complete installation shall be provided by the contractor and includes, but is not limited to permanent or removable / lockable vehicular barriers, grounding rods, grounding conductors, sleeves, concrete pads, concrete reinforced ductbanks, conduits, metering racks and metering enclosures.

E. Utility distribution poles and service entrance ductbank locations shall be staked and surveyed prior to pole installation by the Contractor to verify their proper placement is within the Owner's property and respective utility easements. Contractor shall verify by survey that the pole and service entrance ductbank location and easements do not interfere with existing easements, right-of-ways, or other restricted properties. Conflicts with existing easements and restrictions shall be brought to the attention of the Architect prior to construction.

F. Contractor shall initiate contact with the power provider (retail seller), utility (transmission and distribution), and Owner within 14 days of Notice to Proceed to ensure permanent power will be available to the site. Any delays resulting from lack of this coordination shall be the responsibility of the Contractor.

END OF SECTION 26 05 09

SECTION 26 05 10 CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide manufacturer’s qualified personnel to observe:
   1. Field conditions
   2. Condition of installation
   3. Quality of workmanship
   4. Start-up of equipment
   5. Testing, adjusting, and balancing of equipment

B. Manufacturer’s qualified personnel shall make written report of observations and

recommendations to Architect / Engineer.

1.7 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
1. Rough-in
2. Finish with all appurtenances in place
3. Demonstrations

B. Refer to other specification sections for pre-functional checklist for requirements to aid in preparing mock-ups.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIAL

A. Comply with recognized National rating and approval agencies as well as all codes and ordinances at the federal, state and city levels.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer’s qualified personnel at no additional cost to Owner.

B. Coordination Drawings:
1. Electrical room size and location required and to scale
2. Equipment and accessories, switchgear and piping
3. Indicate clearances and service access.

3.2 ELECTRICAL ACCEPTANCE TESTING

A. Perform electrical acceptance testing and inspections in accordance with the current edition of the International Electrical Testing Association (NETA), *Acceptance Testing Specification* (ATS).

B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed electrical systems and components, both Contractor and user-supplied are:
1. Installed in accordance with design documents and manufacturer’s instructions.
2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA 110 and NFPA 111).

3. Ready to be energized.
4. Operational within industry and manufacturer's tolerances.

3.3 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

3.4 MOCK-UPS

A. Mock up the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fire proofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.

B. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, all lighting controls, covers plates, rough-in boxes, conduits, MC cables, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit or MC Cable routing and conductor fill.

C. Mock up a typical panelboard backbox with Surge Protective Device (SPD) panelboard extension backbox or SPD device.

END OF SECTION 26 05 10

SECTION 26 05 12 **ELECTRICAL SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA**

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 01 and as outlined below.

B. Provide individual submittals based on the project specification section number and description and only items specified or required in that specific project specification section.

C. Submit product data shop drawings only for the following items indicated below when included as part of the project specifications, and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review, typically for basic materials and commodity off-the-shelf materials, and/or to imply that materials shall be provided as specified without exception.

D. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

E. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, in the related O&M manual section.

1.2 ARCHITECT / ENGINEER REVIEW OF SUBMITTALS

A. The Architect / Engineer will:
1. Review requested submittals with reasonable promptness. Specific equipment submittal within a materials specification section that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
2. Affix stamp and initials or signature and indicate requirements for resubmittal or exceptions to submittal as submitted.
3. Return submittals to Contractor for distribution or for resubmission.

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes, or coordination with the work of other trades.

D. The review of a separate item as such will not indicate approval of the assembly in which the item functions.

1.3 SUBSTITUTIONS

A. Do not make requests for product or material substitution employing the procedures of this Section. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 - PRODUCTS

A. Each individual submittal shall be an individual specific electronic data file with the file name resembling the product specification section number and title. Refer to Division 01 for additional data file format and media requirements.

PART 3 - EXECUTION

3.1 SPECIFICATION COMPLIANCE REVIEW

A. Do not submit an outline form of compliance, submit a complete copy with the product data.

B. Mark up a complete copy of the complete specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:).

C. Variances for roduct ot materials typically include updated model numbers or updated versions of the specified product from the same manufacture or an equal or better product from the approved manufactures list. Substutions from manufacture's not on the approved manufacture's will not be reviewed unless prior approval using one of the procedures for substitutions or changes in the contract documents are followed as requried in Division 01.

3.2 COMPOSITE COORDINATION DRAWINGS

A. Produce a set of composite coordination drawings for above ceiling, below ceiling, and below floor of electrical, mechanical, and technology equipment rooms and equipment yards for review and comment within four (4) weeks of receipt of Owner's official Notice to Proceed. Show coordination of items including but not limited to structural and architectural elements, all mechanical and plumbing piping, ductwork, equipment, electrical conduit, low voltage communications and safety/security systems cabling, cable trays, lighting, electrical switchgear, generators and UPSs, and any public or private building utility services.
   1. Prepare the composite plans at one-quarter inch (1/4") equals one-foot scale. Include larger scale sections with vertical elevations of elements as required to confirm coordinate of all elements.
   2. For each room containing major electrical switchgear and each outside equipment area with major electrical switchgear and other equipment also include NEC working space, NEC equipment space, and NEC access to NEC working space, and housekeeping pad location and dimensions.
   3. Prepare coordination drawings to coordinate installations for efficient use of available space allowing for future additional equipment wherever possible, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
   4. Identify field dimensions. Show relation to adjacent or critical features of work or

products.

B. Submit composite coordination shop drawings in plan, elevation and sections, showing receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.
   1. Verify location of wiring devices and outlets, communication devices and outlets, safety and security devices, and other work specified in this Division.
   2. Coordinate with drawing details, site conditions, composite coordination drawings, and millwork other equipment shop drawings prior to installation.
   3. Submit coordination and shop drawings prior to rough-in and fabrication.

3.3 EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal. Do not submit entire product catalogs, submit only specific data sheets indicating required product information and available product options or accessories.

B. Submittal Specification Information:
   1. Every submittal document shall bear the following information as used in the project manual:
      a. The related specification section number
      b. The exact specification section title
      c. Additional identifiers as required in Division 01.
   2. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been submitted or delivered.

C. All product options specified shall be clearly indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as either part of or not part of the product data submitted shall become part of the Contract and shall be assumed to be provided with the product submitted.

D. Mark each copy of standard manufacture’s printed data to identify pertinent products, referenced to specification section and article number.

E. Show reference standards, performance characteristics and capacities; wiring diagrams and controls; component parts; finishes; dimensions and required clearances.

F. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete or strike through information not applicable.

G. Submit drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

H. Show all dimensions of each item of equipment in its to be installed assembled condition with all components assembled. Include a series of drawings of individual components as necessary for reference.

I. Identify field dimensions; show relation to adjacent or critical features or work or products.

J. Submit individually bound shop drawings and product data for the following when specified or provided.

K. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior

to other electrical switchgear dependent on the results of the study for specific product selection by the vendor or contractor for compliance with the study.

1. The emergency life safety power system equipment shall be fully coordinated as required by the NEC.
2. The AIC and WCR ratings of all products meet or exceed the available fault current at that equipment's location.
3. Electrical systems other than life safety power systems shall be coordinated as much as practicable while reducing arc flash energy as much as practical.

L. Required submittals when products are indicated or specified:

1. Fault Current and Overcurrent Device Coordination Analysis. Submit this analysis three (3) weeks prior to any overcurrent device submittal to allow modifications to overcurrent device product selection submittal based on the manufacture's analysis and recommendations at no additional cost to the Owner.
2. Enclosed Switches and Circuit Breakers
3. Enclosed Motor Controllers
4. Panelboards, load centers, and enclosures
5. Wiring devices
6. Lighting fixtures
7. Lighting Controls and Occupancy Sensors
8. Surge Protection Devices
9. Site Lighting Poles, Fixtures, Drivers, and Lamps
10. Electrical controls and time switches
11. Electrical Contactors
13. Transformers
14. Switchboards
15. Metering equipment for energy monitoring and usage
16. Emergency/Standby generator sets and transfer switches
17. Architectural Dimming Systems
18. Theatrical Lighting Systems

3.4 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

3.5 CONTRACTOR RESPONSIBILITIES

A. Review, make corrections or annotations for clarification of manufacturer supplied data, stamp and sign submittals prior to transmittal.

B. Determine and verify:

1. Field measurements
2. Field construction criteria
3. Manufacturer's catalog numbers
4. Conformance with the Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are required, until such submittals have been produced and bear contractor's stamp of acceptance or approval. Do not fabricate products or begin work until return of reviewed submittals with Architect /

Engineer's acceptance.

F. Contractor's responsibility for errors, omissions, or un-approved substitutions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations identified by the Contractor on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service; manufacture's and code required clearances.
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the Contractor for processing or for making corrections for re-submittal.

J. General and Electrical Contractor's Stamp of Approval
1. The general contractor and the electrical contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
2. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
3. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
4. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

3.6 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor. Product and equipment related to site work or other trades which require extensive rough-in, foundations, or structural support shall be submitted as soon as possible after given notice to proceed with construction.

B. Number of submittals required:
1. Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions or coordination drawings.
2. Product Data: Submit electronic data PDF files. Refer to Division 01 for specific requirements. PDF files that are 20MB or larger may indicate that a submittal includes information not specifically relevant to the specific product being provided, information not required for the review of the specific product such as a complete product catalog or catalog section. Contractor shall include only the product data required to review the specific products characteristics for compliance with the contract documents.

C. Accompany submittals with transmittal letter containing:
   1. Date
   2. Project title and number
   3. Contractor's name, address and contact information.
   4. The number of each Shop Drawing, Project Datum and Sample submitted
   5. Other pertinent data as required in Division 01.

D. Submittals shall include:
   1. The date of submission
   2. The project title and number
   3. Contract Identification
   4. The names of:
      a. Contractor
      b. Subcontractor
      c. Supplier
      d. Manufacturer
   5. Identification of the product
   6. Field dimensions, clearly identified as such
   7. Relation to adjacent or critical features of the work or materials
   8. Applicable standards
   9. Identification of deviations from contract documents
   10. Suitable blank space for General Contractor and Architect / Engineer stamps
   11. Contractor's signed and dated Stamp of Approval.

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
   1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
   2. Associated items requiring correlation for efficient function or for installation

3.7 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a complete submittal as if it were the initial submittal unless otherwise instructed in the review comments on the original submittal.
   1. Indicate that the document or sample is a resubmittal
   2. Identify changes made since previous submittals

B. Indicate any additional changes which have been made by the contractor other than those requested by the Architect / Engineer.

END OF SECTION 26 05 12

SECTION 26 05 16 EXCAVATING, BACKFILLING AND COMPACTING FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 apply to this section.

B. Refer to Instructions for substitution of materials and products.

C. Addenda issued during the bidding period that affect this section of the specifications.

1.2 WORK INCLUDED

A. Coordinating all excavating and backfilling for the electrical underground, and all related appurtenances. Provide concrete duct banks as specified in other related Division 26 specification sections.

B. The extent of raceways, excavation, and backfill shall be in conformance with the locations, raceways, elevations and grades shown on the drawings.

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM) Use current edition.
1. ASTM D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3)
2. ASTM D1556, Standard Test method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
3. ASTM D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
4. ASTM D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

B. Local Authority Having Jurisdiction Standards

C. Local Governing Agencies or Utilities

1.4 WARRANTY

A. Provide written warranty against defects in the material and workmanship for the work of this Section for a period of one year from the Date of Substantial Completion of the Project. Refer to Division 1 for Warranty form.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Concrete: Refer to other Division 26 specification section where concrete encasement is required or specified.

B. Cement-Stabilized Sand: Clean, local sand mixed with not less than 1-1/2 sacks of Portland cement per ton; mix in a mill-type mixer.

C. Sand: Clean, local sand

D. Earth Backfill: Clean local material consistent with the surrounding earth material and free of large clods, roots, organic materials, rocks or other debris.

PART 3 – EXECUTION

3.1 EXCAVATION

A. General:
1. All utility trenches shall be constructed in conformance with OSHA trench safety standards.
2. Refer to project Geotechnical Report for additional requirements for excavating and backfilling of utility trenches.
3. Sheeting and shoring shall be accomplished to the extent necessary to maintain the sides of the trench in a vertical position throughout the construction period for trenches five feet in depth or deeper. Where approved, trench sides may be laid back in lieu of shoring to meet OSHA safety standards.
4. Utilities shall not be constructed or laid in a trench in the presence of water. All water shall be sufficiently removed from the trench prior to the raceway placing operation to ensure a dry, firm bed on which to place the raceway.

B. Appurtenances:
1. Any overdepth excavation below appurtenances shall be refilled with cement-stabilized sand.

C. Electrical Trenches:
1. Electrical underground raceways must be the minimum depth required by the local governing authority and Power Company.
2. Trench width for the electrical raceway shall be a minimum of the outside raceway encasement plus 12 inches.
3. Trenches shall be excavated to a depth of at least 6 inches below the conduit raceway. The conduit raceway bedding or concrete encasement shall then be placed in accordance with the specifications, local governing authority, and Power Company standard details.

3.2 BEDDING AND BACKFILL

A. Electrical Trenches:
1. Place backfill, consisting of sand or cement stabilized sand, to a depth of one foot above top of raceway or concrete duct bank and compact to 90% maximum density.
2. Backfill the remainder of the trench in 6 inch lifts with select excavated material and compact as required to achieve density of soil of surrounding area.

B. Utility Locators:
1. Provide metallic locators for utility company raceways as required by respective utility.
2. Refer to other specification sections for additional requirements for underground raceway locators and markers.

END OF SECTION 26 05 16

SECTION 26 05 19 CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical conductors, wire and connector work as shown, and specified.

B. Types: The types of conductors and connectors required for the project include the following:
1. 600V building conductors
2. 600V building conductor connectors

C. Application: The applications for conductors and connectors required on the project are as follows:
1. Power distribution circuitry
2. Lighting branch circuitry
3. Appliance, receptacle, and equipment branch circuitry
4. Motor branch circuitry
5. Control wiring
6. Line voltage

D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 – PRODUCTS – Provide products manufactured in the USA

2.1 CONDUCTORS AND CONNECTORS

A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.

B. Cable Lubricant: Fire resistant, nonflammable, water-based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.

C. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-

Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.

D. Insulation for 2-hour fire rated power cables: Insulation shall meet or exceed the requirements of UL 2196 Fire Test for Electrical Circuit Protection Systems, and UL 44, Standards for Fire Resistive Cable. Conductor ampacity shall be based on 75C. Combination UL Type insulation types are permissible where the required UL Type is part of the combination UL listing.
1. Conductors installed underground: Insulation for underground fire rated conductors shall be wet location, UL Type RHW 75 degrees C, or UL RHW-2 90 degrees C.
2. Conductors installed above ground: Insulation for above ground fire rated conductors shall be UL Type RHH 90C or RHW 75C or UL RHW-2 90C.
3. Electrical Circuit Protective Systems (FHIT) – System 27 of the UL Fire Resistance Directory

E. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
1. All wiring inside lighting fixtures shall be temperature rated per NEC.
2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

Color Code Table	**USE CONTINUOUS COLOR CODED INSULATION THROUGHOUT**					
System/ Phase	**A**	**B**	**C**	**N**	**G**	**IG**
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:
1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.

B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.

C. Conductors:
1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
7. Run feeders their entire length in continuous section without joints or splices.
8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
9. Provide the same size wire form the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
    a. Total voltage drop from the point of service to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
    b. Total voltage drop from the point of service to transformers with adjustable taps, buck-boost transformers, uninterruptable power supplies (UPS), or voltage regulators shall not exceed five-percent of rated voltage.
    c. Total voltage drop from a separately derived system, transformer with adjustable taps, buck-boost transformer, uninterruptable power supply (UPS), or voltage regulator to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
    d. Total voltage drop from the point of service to distribution equipment of the same voltage shall not exceed two-percent of rated voltage.
    e. Branch circuit voltage drop from distribution equipment to the last outlet or utilization equipment shall not exceed three-percent of rated voltage.
    f. Provide the same size branch circuit conductors to last outlet on circuit unless specifically noted or indicated otherwise on the drawings. For 20 amp branch circuits operating at 150-Volts or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating above 150-Volts to 600-Volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and

splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.

12. Support conductors in vertical raceways, as required by the NEC.
13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
17. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor shall be identified with green phasing tape at all accessible locations.
20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
21. Clean conductor surfaces before installing lugs and connectors.
22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
24. Run mains and feeders their entire length in continuous pieces without splices or joints.
25. Color code conductors.
26. Do not install a pull string in conduits containing conductors.
27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.

D. Two-hour fire rated cable:

1. Two-hour fire rated power cable shall be installed per manufacturer’s installation instructions in compliance with UL Fire Resistance Directory, Electrical Circuit Protective Systems (FHIT), and System 27.
2. Two-hour fire rated power cable shall be installed in rigid steel EMT or rigid steel galvanized conduit (RGC) with steel fittings. Provide fire rated sealant to the end of the raceway to prevent gases from migrating from the fire rated cable into the equipment.
3. Provide two-hour rated cable where conduit or cables enters or passes through the building envelope at areas or rooms that are not two-hour rated equipment rooms for the following:
   a. Fire Pump feeders.
   b. Emergency Feeders (Life Safety) as defined by NFPA Article 700.
   c. Legally required level one standby systems as defined by NFPA 110 and NFPA Article 701. These systems include but are not limited to those used to aid firefighting and rescue operations, smoke removal systems, and elevators

designated for ADA and/or fire rescue operations.

4. Alternate two hour rated feeder conductor sizes may be substituted for the required conductor ampacity, voltage drop, or equipment lug terminations based on two-hour fire rated conductor standard size availability or provided equipment manufacturer's cable terminations. Substituted conductor ampacity shall meet or exceed the specified cable ampacity and exceed the required equipment minimum circuit ampacity. Provide substitutions and the required conduit sets and sizes as required for the substitutions at no additional cost to the Owner.

E. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.

F. Splices and Joints:
1. In accordance with UL 486A, C, D, E, and NEC.
2. Aboveground Circuits (No. 10 AWG and smaller):
   a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220˚ F, with integral insulation, approved for copper and aluminum conductors.
   b. The integral insulator shall have a skirt to completely cover the stripped wires.
   c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
3. Motor connections:
   a. All AHU motors connections shall be split bolt connectors.
   b. All non-AHU motors 10 HP and larger shall be split bolt connectors.
   c. All non-AHU motors less than 10 HP shall be split bolt connectors or as recommended by the manufacturer.

G. Aboveground Circuits (No. 8 AWG and larger):
1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

H. Underground Branch Circuits and Feeders:
1. Submersible connectors in accordance with UL 486D, rated 600 V, 190˚F, with integral insulation.

3.2 TESTING

A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.

B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing

procedures and in the use of all test equipment.

1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K

2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.

C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.

D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.

SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT
(Specification Paragraph 3.2, C)

Date_____

Contract and Work Location: ___
Contract (Project) No.: _
Circuit Identification: ___
(Dwg., Title, Number and Ckt. Number)

Test Equipment: _____
(Make, Model, Serial No., Etc.)
Applied Test Voltage _____
Normal Oper. Voltage _____
Cable Installation: New _____ Used _____
(Date) (No. Years)
Cable Size _____AWG
Cable Length _____Ft.
Cable Material _____Cu _____Al
Temperature _____ Humidity _____

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION 26 05 19

SECTION 26 05 26 ELECTRICAL GROUNDING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Grounding shall conform to the requirements of:
1. National Electrical Code.
2. Governing local codes.
3. All Local Utility Companies

B. Ground effectively and permanently.
1. Neutral conductor at the main service disconnect and other separately derived systems.
2. All conduit systems.
3. All electrical equipment and related current carrying supports or structures.
4. All metal piping systems.
5. All building structural metal frames.
6. All telephone/voice/video/CATV/data utilities

1.2 REFERENCE STANDARDS

A. ANSI/IEEE Standard 142 - "Recommended Practice for Grounding of Industrial and Commercial Power Systems."

B. ANSI/UL 467 - "Safety Standard for Grounding and Bonding Equipment."

C. Article 250 of the NEC (NFPA 70) for grounding.

D. NECA – Standard of Installation

E. NETA ATS – Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems

F. EIA / TIA 607

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Copperweld

B. nVent ERICO

C. Burndy

D. O. Z Gedney

E. Eaton

2.2 GROUNDING ELECTRODES

A. Driven Rod Electrode
1. 3/4" x 10'-0" copper clad grounding electrode.
2. UL listed.

3. Approved thermal fusion connector methods (exothermic).

B. Metal frame of building or enclosure.

C. Foundation concrete encased rebar.

2.3 DATA / VOICE COMMUNICATIONS CLOSET GROUND BAR

A. MDF closets/head end rooms: Erico Cadweld #B544A028 ground bar with 7/16-inch holes.

B. IDF closets, Erico Cadweld #B542A004 ground bar with 7/16-inch holes.

C. Heavy-duty, two bolt type, copper alloy or bronze for grounding and bonding applications, in configurations required for particular installation.

2.4 EXOTHERMIC CONNECTIONS

A. Exothermic type for underground and structural steel; Cadweld

B. Exothermic materials, accessories, and tools for preparing and making permanent field connections between grounding system components.

2.5 WIRE

A. Stranded, copper cable

B. Foundation Electrodes: 4/0 AWG

C. Grounding Electrode Conductor: Size to meet NFPA 70 requirements

PART 3 - EXECUTION

3.1 GROUNDING AND BONDING

A. In the service equipment, provide a separate (dedicated) ground bus.
1. Bond the ground bus with copper bus bar or cable, of equal or greater current carrying capacity of the service grounding conductor, to the neutral bar.
2. Resistance of neutral to ground shall not exceed 10 Ohms.
3. Connect the electric service grounding electrode conductors to the incoming metal water pipe system (when available, using a suitable ground clamp) and to a supplemental electrode such as a ground rod or ground .ring.
4. Provide grounding and bonding at the power company’s metering equipment.
5. Provide access and cover for access to the ground grid and removable connections for testing the system.

B. Connect the grounding electrode conductor between the ground bus and the grounding electrode system.
1. In rigid PVC conduit.
2. Provide thermo fusion connection for each rod ground electrode.
   a. All rod electrodes shall be located outside the building in non-paved areas where available. Access cover top shall be flush with finish grade or floor.
   b. Install rod electrodes as required. Install additional rod electrodes as required to achieve specified resistance to ground.

c. The minimum distance between driven ground rod electrodes shall be 10'.

3. The total ground resistance shall not exceed 10 Ohms for service entrance grounds and 25 Ohms for equipment grounds.
   a. Where this condition cannot be obtained with one electrode, install a longer electrode, deep-driven sectional electrodes, or additional grounding electrodes until the required ground resistance is obtained.

C. Provide an insulated equipment grounding conductor inside all conduits, raceways, surface raceways, gutters and wireways. The ground wire shall be bonded to each box to suitable lug, bus, or bushing. All bonding jumpers shall be routed inside conduit or raceway.

D. Provide an insulated isolated equipment grounding conductor in addition to the insulated equipment grounding conductor for all isolated grounding feeders, branch circuits, outlets and isolated grounding receptacles.

E. Provide all conduit terminating in switchgear, transformers, switchboards, panelboards and voice/data outlets with grounding bushings, where required, and ground wire extended to ground bus in equipment. Install grounding bushings where reducing washers are used and concentric and eccentric knock-outs are used.

F. Main bus and building grounding electrode conductor installation shall be witnessed by the Architect / Engineer.

G. Provide bonding to meet Regulatory Requirements.

H. Interface with lightning protection system when lightning protection system is specified.

I. Locate and install anchors, fasteners, and supports in accordance with NECA “Standard of Installation”.

J. Do not fasten supports to pipes, ducts, mechanical equipment, or conduit.

K. Do not use spring steel clips and clamps.

L. Do not use powder-actuated anchors.

M. Do not drill or cut structural members.

N. Do not use compression or mechanical connectors underground.

O. Do not use sheetmetal or self-drilling screws for bonding connections. Provide listed or approved connectors.

P. Provide grounding access well for each driven ground electrode, not located in manholes or pull boxes.
   1. Access well top shall be flush with finish paved surfaces.
   2. Ground access wells located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.
   3. Provide thermal fusion (exothermic) connectors approved for direct burial.

3.2 METAL FRAME OF BUILDING OR STRUCTURE

A. Effectively ground the building steel or structure per NEC 250-52 (2).

3.3 UFER GROUND

A. Provide a UFER ground at bottom of building slab per NEC 250.52 (3), bond to building steel.

3.5 MISCELLANEOUS REQUIREMENTS

A. Continuity of the equipment grounding system shall be maintained throughout the project. Equipment grounding jumpers shall be installed across conduit expansion fittings, liquid-tight flexible metal and flexible metal conduit, and other non-electrically continuous raceway fittings.

B. Equipment grounding conductors and grounding electrode conductor shall be stranded copper conductors and run in a suitable raceway. Grounding conductors and grounding electrode conductor shall be continuous, without joints or splices over their entire length, except as allowed by NFPA 70/NEC.

C. For separately derived alternating current system grounds, bond the case and neutral of each transformer secondary winding directly to the nearest available effectively grounded structural metal member as required in NEC 250.

D. Exterior Electrical Equipment Racks:
1. Provide driven ground electrode.

E. Technology/Data/Voice Communications, CATV, CCTV, and MATV Equipment Grounding: Provide grounding electrode conductor from the communications service equipment to the building grounding system as required. Grounding shall conform to ANSI/TIA/EIA 607(A) – Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum. Bonding shall be of low impedance to assure electrical continuity between bonded elements.
1. MDF Closets Telecommunications Main Ground Bar (TMGB): Provide Erico #EGBA14424MM ground bar, wall mounted to the telecommunications plywood backboard. Provide one #3 AWG insulated ground conductor from ground bar to building steel. Provide #2/0 AWG insulated ground conductor to the building electrical service ground at the nearest electrical switchboard or panelboard.
2. IDF Closets Telecommunications Ground Bar (TGB): Provide Erico #EGBA14410FF ground bar mounted to the telecommunications plywood backboard. Provide one #6 AWG insulated ground conductor from ground bar to building steel and to ground bus of nearest electrical panelboard or switchboard.
3. Provide #2/0 AWG insulated ground conductor between each TMGB and all TGBs.
4. Provide #2/0 AWG insulated ground conductor from TMGB to electrical service ground bus at main electrical service switch.
5. Bond each equipment rack, cabinets, frames, together and with #6 AWG insulated ground conductor to the local TMGB / TGB. Bond and ground equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.
6. Route TMGB – TGB ground conductor using the shortest, straightest, route practical with long radius curves.
7. All conduits terminating to cable trays, wireways, and racks shall be mechanically fastened. When connected to a cable tray or rack, it must be connected with

ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or IDF room grounding bar using #6 AWG copper.

F. Ground lighting fixture bodies to the conduit grounding system.

G. Bond receptacle ground to the box and conduit ground system, except where and insulated/isolated grounding receptacle or outlet is specified.

H. Ground connections to building steel, grounding electrodes and all underground connections shall be by thermal fusion (exothermic).

I. Provide OZ Type “BJ” bonding jumper at all expansion joints, points of electrical discontinuity or connections in conduit where firm mechanical bond is not possible, such as flexible connections, insulating couplings, etc.

J. Ground each lighting and power panelboard by connecting the grounding conductors to the grounding stud.

K. Ground each secondary dry-type transformer to the ground bus of the primary side panelboard. Provide a bonding jumper between the ground stud and the neutral. Ground transformer ground stud to ground ring if a ground ring is installed or the nearest structural steel member.

L. Bond every item of equipment served by the electrical system to the building equipment ground system. This includes, but is not limited to, switchboards, panelboards, disconnect switches, receptacles, cable trays, controls, fans, air handing units, pumps and flexible duct connections.

M. Ground each light pole, power distribution poles, and metal conduit stub-ups at each light pole base.

N. Ground all metal conduit including metal conduit used for bends and penetrations through concrete.

O. Bond hot water and cold water piping together at each domestic water heater.

3.6 MANHOLE AND/OR PULL BOX GROUNDING

A. Provide a driven ground rod and ground bond ring in each power and telephone manhole or pull box. Bond cable racks and medium voltage cable shields at splices and terminations, ductbank conduit ground bushings and all other metal components in manholes or pull box to the ground ring.

3.7 COORDINATION

A. General: Coordinate installation of grounding connections for equipment with equipment installation work.

3.8 TESTING

A. Ground Resistance Test: Perform a ground resistance test for comparison to future inspection and testing data by the Owner. Test shall be performed using a Biddle Megger Earth Tester or equivalent test instrument. The test shall not be performed within 48 hours after the last rainfall.
   1. Inspect and test in accordance with NETA ATS except Section 4

2. Grounding and Bonding: Perform inspections and tests listed in NETA ATS, Section 7.13

B. True Root Mean Square (RMS) AC measurements: The True RMS AC Measure test should be performed for all bonding conductors. The recommended maximum AC current value on any bonding conductor should be less than 1 ampere (A). The recommended maximum DC current value should be less than 500 milliamperes (mA). If abnormally high AC current levels are present on any bonding conductor, a dangerous faulty wiring condition likely exists within the room.

C. Two-Point Bonding Measurements: The Two-point Bonding test should be performed for all bonding conductors. This test should be performed using an earth grounding resistance tester configured for a continuity test. The test is performed by connecting the meter leads between the nearest available grounding electrode (e.g., structural steel) and the TMGB or TGB. The recommended maximum value for the bonding resistance between these two points is 0.1 Ohms (100 milliohms).

D. Submittals: Furnish instruments and personnel required for tests. Personnel shall be trained in all aspects of testing grounding systems and shall be formally trained on using all test equipment required. Submit 2 copies of certified test results for Owner's record and submit 4 copies of certified test results to Architect / Engineer for review. Test reports shall include date and time of tests, relative humidity, temperature, and weather conditions.

E. Notify Owner’s Commissioning Authority (CxA) prior to performing any tests to the CxA may witness tests at his/her discretion. Refer to Section 26 01 00 Commissioning of Electrical Systems.

END OF SECTION 26 05 26

SECTION 26 05 33 CONDUIT SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install a complete system of electrical conduits and fittings.

1.2 REFERENCE STANDARDS

A. National Electrical Code

B. Local codes and ordinances

C. UL

D. ETL

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products manufactured in the USA

A. Raceways:
1. Allied, International Metal Hose, Ipex, Heritage Plastics, Wheatland, Can-Tex, Carlon, Certain-Teed, Anamet, Inc., Electri-Flex Co., Western Tube and Conduit, Sentinel Conduit.
2. PVC Coated RGC: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass, United Fiberglass

B. Fittings:
1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Raco, Ipex, International Metal Hose, Lew Electric Fittings Co.
2. PVC Coated ferrous fittings: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

C. Condulets and Conduit Bodies:
1. Appleton, Form 85
2. PVC Coated: Robroy Perma-cote or Plasti-Bond, – no exceptions
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds
4. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass

D. Steel MC Cable for light fixture whips:
1. AFC

2. Southwire
3. General Cable
4. Kaf-Tech

2.2 GENERAL

A. The minimum conduit size shall be ¾-inch unless indicated otherwise in Divisions 26, 27 or 28.
   1. Branch Circuits: Minimum conduit size shall be ¾-inch.
   2. Feeder Circuits: Minimum conduit size shall be ¾-inches.
   3. Technology, telecommunications, and low voltage systems: The minimum conduit size shall be ¾-inches unless noted or indicated otherwise.
   4. The minimum conduit size between buildings for technology, voice, data, fire alarm, video, security, surveillance, BMCS, and other telecommunications shall be 2-inch unless indicated otherwise.

B. The minimum conduit size for flexible metallic conduit for tap connections to individual light fixtures shall be ½ inch, or steel metal clad (MC) cable with insulated ground conductor maximum 6 feet.

C. Electrical nonmetallic tubing, flexible polyethylene or PVC tubing shall not be used on this project.

D. BX and AC cable shall not be used on this project.

E. PVC elbows shall not be used on this project.

F. Intermediate metal conduit (IMC) shall not be used on this project.

2.3 RIGID METAL CONDUIT

A. UL labeled, Schedule 40:
   1. Mild steel pipe, zinc coated inside and out
   2. Aluminum Alloy 6063, T-1 temper
   3. Threaded ends
   4. Insulated bushings

B. Fittings shall meet the same requirements as rigid metal conduits.
   1. UL labeled
   2. Threaded fittings

2.4 ELECTRICAL METALLIC TUBING (EMT)

A. UL labeled, standard weight:
   1. Cold rolled steel tubing, zinc coated inside and out
   2. Aluminum Alloy 6005, 6063. Temper T-1

B. Fittings shall meet the same requirements as EMT conduits.
   1. UL labeled
   2. Insulated throat connectors
   3. Steel fittings with setscrews with lock nuts on threaded ends, no snap locks
   4. Cast metal fittings are not approved
   5. Uni-couple type connectors are not approved
   6. Split ring, anti-short bushings are not approved

2.5 RTRC CONDUIT FITTINGS AND CONDUIT BODIES

A. UL listed

B. Standard wall thickness sizes ¼-inch through 4-inch

C. Underground medium wall thickness sizes 5 and 6-inch

D. Conduit interface joints above grade, gasket joint below grade

E. Extra heavy wall for above ground and/or UL Class 1 Division 2 and Class 1 Zone 2 applications.

2.6 PVC COATED RIGID STEEL WITH URETHANE INTERIOR COATING

A. The PVC coated galvanized rigid conduit and fittings must be ETL Listed and Verified. The PVC coating must have been investigated and verified by ETL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be ETL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed for the hazard conditions to which they are to be used. All conduit and fittings must be new, unused material. Applicable UL standards may include UL 6 Standard for Safety, Rigid Metal Conduit, and UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.

B. The PVC coated galvanized rigid conduit and fittings must be ETL Verified to the Intertek ETL SEMKO High Temperature H_2O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.

C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.

D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.

E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.

F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.

G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.

H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.

I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).

J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.

K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.

L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
1. Conduit and condulet exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.

M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.

N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel

2.7 STEEL FLEXIBLE CONDUIT

A. Steel flexible metallic conduit:
1. Zinc coated inside and out
2. 18-inches minimum length, 24-inches maximum length

B. Steel flexible metallic conduit for tap connections to light fixtures where steel MC Cable fixture whips are not used:
1. 18 inches minimum length; 6 feet maximum length

C. Liquid tight flexible steel conduit
1. Type L.A. - Grounded - UL Approved
2. 18-inches minimum length, 24-inches maximum length

2.8 PVC CONDUIT

A. UL labeled Schedule 40 and Schedule 80

B. PVC fittings and solvent welded joints

C. Acceptable PVC condulet manufacturer: Ipex, Cantex

2.9 CONDULETS AND CONDUIT BODIES

A. UL Labeled

B. Form 85

C. PVC Coated: Form 8

D. LBC Condulets shall be used for size 2 inch and above.

E. LL and LR Condulets shall not be used for 2 inch and above

2.10 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

A. Conduit supports and pads suitable for direct sunlight, conduit size, weight, quantity and roof system with unistrut supports and accessories. Conduit supports shall allow for conduit expansion and contraction.

B. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof mounted supports for conduits and boxes.

C. Approved Manufacturer:
1. Portable Pipe Hangers
2. Eaton B-Line
3. Miro Industries, Inc.

2.11 ALUMINUM CONDUIT

A. UL Labeled

B. Aluminum fittings shall meet the same requirements of aluminum conduits, compatible steel fittings.
1. UL Labeled for use with aluminum conduit.

2.12 STAINLESS STEEL CONDUIT

A. UL Labeled

B. Rigid Stainless Steel:
1. Type 304 Stainless Steel
2. Threaded ends
3. Insulated Bushings

C. EMT:
1. Type 304 Stainless Steel
2. Compression Fittings
3. Insulated Bushings

D. Fittings, elbows, nipples, strut, device box, clamps straps, etc.
1. Type 304 Stainless Steel

2.13 ELECTRICAL NON-METALLIC TUBING (ENT)

A. UL labeled Schedule 40

B. PVC fittings and solvent welded joints

C. Acceptable manufacture: Carlon

2.14 EXTERIOR IN-GRADE PULL BOXES

A. Enclosures, boxes and covers are required to conform to all test provisions of the most current American Association of State Highway and Transportation Officials (AASHTO) standards for H-20 loading applications.
   1. AASHTO H-20 certified precast concrete, cast iron or other AASHTO recognized materials, rated for deliberate traffic.
   2. Conduit entry knock-outs as required
   3. Bolt down galvanized steel/cast iron covers
   4. Thin wall knocks outs as required
   4. Integral bottom
   5. Box height as required for specified conduit depth and required top elevation.
   6. Concrete design strength of minimum 5,500 PSI at 28-days
   7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-inches beyond the enclosures exterior dimension.
   8. Size and volume as required for application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical conduits and fittings for all wiring of any type unless specifically specified or instructed to do otherwise. Install conduits and fittings in accordance with local codes and applicable sections of the NECA “Standard of Installation”, concealed where possible.
   1. Fasten conduit supports to building structure and surfaces; do not support to roof deck.
   2. Arrange supports to prevent misalignment during wiring installation.
   3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
   4. Do not attach conduit to ceiling support wires.
   5. Arrange conduit to maintain head room and present neat appearance.
   6. Maintain 4-inch clearance between conduit and rooftop surfaces.
   7. Cut conduit square using saw or pipe cutter; de-burr cut ends.
   8. Bring conduit to shoulder of fittings; fasten securely.
   9. Conduit penetrations to all individual motor controllers, VFDs, and motor control cabinets shall only be made at the bottom of the enclosure. For other equipment, provide listed water sealing conduit hubs to fasten conduit to sides or tops of electrical equipment enclosures, device box, gutter, wireway, disconnect, etc.
   10. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
   11. Ground and bond conduit as required.
   12. Identify conduit as required.
   13. Route all conduits above building slab perpendicular or parallel to building lines.
   14. Do not use no-thread couplings and connectors for galvanized steel, PVC coated galvanized steel, or aluminum rigid conduit.

B. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.

C. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.

D. Securely fasten conduits, supports and boxes, to ceiling (not roof deck), walls, with Rawl Plugs or approved equal anchors. Use lead cinch anchors or pressed anchors. Use only

cadmium plated or galvanized bolts, screws. Plastic anchors and lead anchors shall not be used for overhead applications.

E. Provide separate raceway systems for each of the following when specified, indicated or required:
   1. 120/208 volt circuits
   2. 277/480 volt circuits
   3. Emergency
      a. Life safety branch
      b. Critical branch
      c. Equipment branch
   4. Voice/Data
   5. Sound reinforcement
   6. Theatrical and Architectural Dimming Controls
   7. MATV/CATV
   8. Security CCTV
   9. Security System
   10. Communications / PA Systems / Sound System Line Input and Speakers
   11. Fire Alarm
   12. Lighting Control Systems
   13. Building Management Control Systems

F. Unless shown otherwise, do not install conduit in or below concrete building slabs.

G. Unless shown otherwise, do not install conduit horizontally in concrete slabs.

H. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing. Conduit for equipment mounted on roof curbs shall be routed through the roof curb. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise. Where specifically indicated to be routed or mounted on the roof, supports shall be as specified, as recommended by roofing manufacturer and roof support manufacturer and as required by NEC. Place supports every five feet along conduit run and within 3 feet of all bends, condulets, and junction boxes. Provide roofing pad under stands at directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.

I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer’s approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.

J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer’s Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer’s representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer’s representative shall certify the installation is in accordance with manufacturer’s installation instructions. Submit copies of installation certification prior to cover-up of underground installation.

K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
   1. Provide insulated throat connectors for EMT conduits.
   2. Provide insulated bushing on all rigid conduit terminations.
   3. Provide locknuts inside and outside of all boxes and enclosures.

4. Provide threaded type plastic bushing at all boxes and enclosures

L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
1. Do not support from structural bridging.
2. Do not support from metal roof deck.

M. Completely install each conduit run prior to pulling conductors. All boxes are to be accessible after completion of construction.

N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pours.

O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.

P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
1. Cable Tension:
   a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
   b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
   c. 1000 lbs. per basket grip.
2. Sidewall pressure: 500 lbs./ft.
3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
   a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
   b. Two (2) equivalent 90-degree bends: not more than one hundred feet (100') between pull points.
   c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet (150') between pull points.
   d. Straight pull: not more than two hundred feet (200') between pull points.
4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.

Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which

exceed 400-feet, and where conduits cross building expansion joints.

R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.

S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.

T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.

U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.

V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.

W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt "wings" are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.

X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with "Tee" conduit at motor outlet height for flexible conduit.

Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.

Z. Where "LB" condulets are used, 2-inches and larger shall be type "LBD".

AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.

BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to equipment, light fixtures, power poles, etc. They are not to be used in lieu of conduit runs. They shall not be used for wall or roof penetrations unless they are installed in a PVC coated RGC conduit sleeve at least one size larger than the OD of the flexible conduit.

CC. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.

DD. “Daisy Chaining” light fixtures installed for lay-in ceiling areas is not allowed. Each light fixture shall have its own fixture whip from junction box. The only exception being light fixtures installed end to end using chase nipples between them, or light fixtures recessed in non-accessible ceilings.

EE. In above ceiling applications, do not install raceways, junction boxes, gutters, disconnects, etc. within 36 inches directly in front of HVAC control boxes or other equipment requiring access from a point starting from the top of control box / equipment down to ceiling.

FF. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.

GG. Install minimum size 2-inch nipple, at least one, between multi-sectional panels for branch circuit independent of feeder conductors.

3.2 CONDUITS

A. Conduit above grade indoors:
   1. Concealed Conduits: EMT with set screw fittings
   2. Exposed conduits:
      a. Below nine feet AFF where not directly attached and against building walls, ceiling, or structure: Rigid metal conduit or x-wall RTRC.
      b. Where subject to physical damage: Rigid metal conduit or x-wall RTRC.
      c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit
      d. Damp Locations: Aluminum rigid conduit or x-wall RTRC.
      e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid galvanized steel or x-wall RTRC when installed below 18-inches above finished floor.

B. Conduit installed above grade outdoors:
   1. Galvanized rigid steel or x-wall RTRC for conduits up utility poles and where subject to physical damage or where located less than four feet above finished floor.
   2. Aluminum or x-wall RTRC where not subject to physical damage and where located four feet above finished floor.

C. Conduit where indicated underground:
   1. PVC Coated Galvanized rigid steel or RTRC conduit elbows and Schedule 80 PVC, RTRC, or PVC coated galvanized steel straight run conduits. PVC conduits for underground branch circuits shall be Schedule 80 or Schedule 40 PVC.
      a. PVC conduit and fittings shall be used only for straight horizontal runs

and for vertical risers at site lighting pole bases. Bending straight sections of PVC conduit to less than 25-foot radius or the use of PVC factory bends is not allowed.

b. Change in direction of conduit runs, either vertical or horizontal, shall be with RTRC or PVC coated galvanized steel elbows or long sweep bends of straight PVC conduit sections. Long sweep bends of straight PVC 20-foot sections shall have a minimum radius of curvature of 25 feet and a maximum arc of 22.5degrees. Multiple long sweep bends of straight PVC sections shall be separated by a minimum of 20-feet of straight, linear, PVC sections.

c. Provide RTRC or PVC coated rigid galvanized steel conduit elbows and fittings with urethane interior coating at all changes in direction with radius of less than 25-feet and at all vertical runs to 18 inches above finished floor elevation. For interior slab penetrations, provide continuous RTRC or PVC coated rigid galvanized steel conduit and fittings with urethane interior coating from change in direction to 18 inches above finished floor elevation, except where stubbed-up under and inside equipment or switchgear where conduit shall be terminated at minimum two inches above concrete housekeeping pad.

d. Elbows for underground electrical service entrance, feeders, transformer primary / secondary, telecommunication, and low voltage conduits shall be RTRC or PVC coated rigid galvanized steel with long radius as follows:
   1) Up to 1-inch conduit, minimum 12-inch radius.
   2) 1.5-inch conduit, minimum 18-inch radius.
   3) 2-inch conduit, minimum 24-inch radius.
   4) 2.5-inch conduit, minimum 30-inch radius.
   5) 3-inch conduit, minimum 36-inch radius.
   6) 3.5 to 6-inch conduit, minimum 48-inch radius.

e. Conduit for all floor boxes shall be routed below building slab from floor box to nearest column, wall, or as indicated.

f. Conduits shall not be routed horizontally in building slab, grade beams or pavement.

2. Encase all underground conduits in concrete.
   a. Concrete shall be tinted red throughout with a ratio of 10 pounds of dye per yard of concrete unless prohibited by utility for utility conduits. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications. Where utility does not require but allows concrete encasement of conduits, provide concrete encasement as specified herein.
   b. Provide minimum 3-inch concrete encasement around conduits.
   c. Provide conduit spacers for parallel branch/feeder conduits.
   d. When prior written approval from Owner and Architect to omit concrete encasement of conduits below building slab is given, conduits either specified or approved in writing to be routed under building slab without concrete encasement for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.
   e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.
3. Install building voice / data / video / communications main service conduits and

electrical service transformer primary and secondary conduits with top of concrete encasement minimum 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of concrete encasement at 36 inches minimum below finished grade or pavement.

4. Provide two “caution” plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.
5. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill or concrete.
6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter ¼-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product minimum strength of 2,500 PSI.
9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.

D. Conduit shown in concrete walls, floor or roof slab:
   1. PVC Coated Galvanized Rigid steel.

E. Conduits that penetrate concrete slab, or within 100 feet of cooling towers, or at designated corrosive locations.
   1. RTRC
   2. PVC coated galvanized rigid steel

F. Connections to equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
   1. Liquid tight flexible metal conduit (1/2 inch may be used for roof top supply / exhaust fans only)
   2. Liquid tight flexible metal conduit for 24-inch maximum length
   3. Conduit for roof-mounted equipment shall be routed inside the roof curb assembly roof opening. Provide permanent lock-off device at panelboard circuit breakers serving roof equipment and accessories to enable tag-out procedures for all power routed through roof curb and to the roof mounted equipment and accessories.

G. Light fixture whips:
   1. Accessible ceilings and open structure: ½-inch flexible steel conduit or steel MC cable, length not to exceed 6-feet.

2. Non-accessible ceilings: ½-inch flexible steel conduit. Length as required to make a tap at an accessible j-box. Recessed light fixtures in non-accessible ceilings may be daisy chained using the light fixture's integral, UL listed j-box or internal wire way that is accessible through fixture from below the ceiling.
3. Dedicated insulated ground wire.
4. Light fixture whips shall not rest on ceiling grid or tile.
5. Light fixture whips shall not be supported from the ceiling suspension system. Support from the structure with #13 AWG galvanized iron wire pendants and Caddy clips. Do not support conduit from structural bridging. Flexible conduit and steel MC cable shall be kept a minimum of 2 inches clear of roof deck.

3.3 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, all floors other than grade level, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
2. Sleeves shall extend 3-inches above the finished floor.

B. Sleeves in concrete or masonry walls shall be RTRC or Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.

C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or smoke rating. Refer to Architecture drawings for locations of rated walls.

D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to install a water stop inside wall penetration. Internally seal low voltage cabling conduit penetrations with waterproof caulking.

E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with ¼-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.

F. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.

G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

3.4 POWER DISTRIBUTION UNDERGROUND FEEDER CONDUIT AND UNDERGROUND SERVICE ENTRANCE CONDUIT

A. Power underground feeder and service entrance shall be of individual conduit encased in concrete. Unless shown otherwise, the type of conduit used shall not be mixed in any one underground conduit and shall be the size indicated on the drawings. The concrete encasement surrounding the underground conduit shall be rectangular in cross-section,

having a minimum concrete thickness of 3-inches, except that conduit for 120V and above shall be separated from control and signal conduits by a minimum concrete thickness of 3-inches. Encasement concrete shall be tinted in red.

B. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel shall be drawn through until each conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.

C. Furnish the exact dimensions and location of power underground conduit to be encased in time to prevent delay in the concrete work.

D. Conduit for service entrance underground conduits shall be as indicated on the drawings.

E. Primary power underground conduit shall be installed in accordance with utility company standards and the utility company specifications for this project.

3.5 TELECOMMUNICATIONS, LOW VOLTAGE AND EMPTY CONDUIT SYSTEM RACEWAYS

A. Conduit shall be installed in accordance with the specified requirements for conduit and with the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.

B. Conduits shall be installed from outlet box to above an accessible ceiling. All cables routed through open spaces (no-ceiling below roof deck or above floor deck) shall be routed in conduit. Telecommunications systems, CATV, CCTV, fire alarm and BMCS cables can be installed above accessible ceilings without conduit. Cables installed above accessible ceiling shall be plenum rated. Conduit rough in of these cables shall include a 90-degree turn-out to an accessible location with insulated bushings on the end of the conduit.
   1. Provide conduit from each telecommunications outlet box to accessible ceiling plenum.
   2. Provide conduit from each security / surveillance device outlet box to accessible ceiling plenum.
   3. Provide two conduits for each multi-media outlet box and each outlet box indicated to contain more than four data, audio, or video drops to accessible ceiling plenum.
   4. Provide the following minimum conduits for telecommunications and multi-media wall, floor, and ceiling mounted outlet boxes. Use the largest diameter conduit indicated below unless instructed otherwise in writing from the Architect:
      a. Non-masonry outlet box: Two 1-inch conduits.
      b. Masonry outlet box: Two 1-inch conduits, or three 3/4-inch conduits.
      c. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation.

C. All conduit in which cable is to be installed by others shall have pull string installed. The nylon pull string shall have not less than 200 lb. tensile strength. Not less than 12-inches of slack shall be left at each end. Provide blank cover plate before substantial completion if box is for a future installation after substantial completion of the project. Conduit shall extend to a minimum six inches above nearest accessible ceiling and be turned horizontally with plastic bushing at terminations.

D. Conduits for Building Entrance Facilities:
   1. Underground Outside Plant: Install a pull box every 300-feet or after 180 degree turns.
   2. Inside Plant: Install a pull box every 150-feet or after 180 degree turns. All turns shall be large sweeps, not sharp 90s, with the radius of the sweep at least 10X the diameter of the conduit. Hence, a 4-inch conduit requires a 40-inch minimum radial sweep. If field conditions absolutely mandate a sharp 90-degree bend to be installed, then a pull box shall be installed at that location regardless of distance.
   3. Building entrance facilities shall not terminate in an IDF or any other space except the MDF.
   4. Coordinate the termination location of the building entrance facilities in the MDF with the room layout and equipment configuration.
   5. Provide 4-inch conduit unless indicated otherwise. Provide (3) fabric innerducts in each 4-inch conduit.

3.6 EXTERIOR IN-GRADE PULL BOXES

A. Provide pull boxes where specified and as required.

B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.

C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

3.7 ALUMINUM ALLOY CONDUCTORS

A. Where aluminum alloy conductors are specified, approved and substituted for copper conductors, provide the required conduit size based on conduit fill using NEC or recognized cable manufacturer’s conduit fill tables for aluminum alloy compact conductors.

3.8 IDENTIFICATION

A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V or 277/480V) or signal / telecommunication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION 26 05 33

SECTION 26 05 35 ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

A. UL Label: Products shall be UL listed to the extent possible.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.

B. Raceways: Refer to related sections.

C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.

D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.

B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.

C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.

D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.

E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.

F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable condulet, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For all AHU or fan motors and all other motors 10 HP and larger, at the motor connection do not use wire nuts. Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor Connection Kit.

G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives, Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers, electrical disconnects, food service / processing equipment, electronics, control panels and Owner furnished equipment:

1. Make conduit penetrations only at the bottom flat surface of the equipment and only where permitted by the equipment manufacturer to avoid un-intentional water entry. Coordinate installation of electrical connections for equipment with equipment installation work. Where equipment manufacture does not permit a bottom conduit entry, verify with Owner/Engineer and locate the conduit entry at the side surface as close as possible to the bottom of the enclosure.
2. Where conduit originates from an elevation above the conduit entry, provide a “T” condulet below the enclosure’s bottom elevation. Provide conduit from the condulet up to the enclosure bottom horizontal surface for electrical connection.

H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.

I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.

END OF SECTION 26 05 35

SECTION 26 05 37 ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS

A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.
   1. Type of Various Locations:
      a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
      b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
      c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
      d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
      e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
      f. Surface: Type FS or FD box with surface cover.
      g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
      h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
      i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements
   2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.

B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate

with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.

C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.

D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
   1. Type for Various Locations:
      a. Minimum Size: 4-inch square, 2-1/8-inches deep.
      b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
      c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners

E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.

F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.

G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

PART 3 - EXECUTION

3.1 INSTALLATION OF BOXES AND FITTINGS

A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.

B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.

C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, voice, video, and multi-media outlet boxes at locations other than wall mounted interactive boards, video or visual displays. Provide single gang only, 3-inch deep outlet boxes mounted long axis vertically for security, access control, and video surveillance, coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-1/8-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required.

D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All

junction box or pull box openings shall be side or bottom accessible. Removal of light fixtures, mechanical equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling for low voltage terminations shall face towards the floor.

E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes can be used.

F. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.

G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.

H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.

I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.

J. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.

K. Provide knockout closures to cap unused knockout holes in boxes.

L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.

M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.

N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.

O. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.

P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.

Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of 304 stainless steel, weatherproof NEMA 4X construction.

R. Identification: Paint the exterior and cover plates of building interior junction boxes and pull boxes located above accessible ceilings or non-finished areas to correspond to the following colors:
1. Orange: - 480/277 VAC systems
2. Light Blue: - 240 VAC three phase delta systems.
3. Red – All Emergency circuits, regardless of voltage, and fire alarm system.
4. Light Green - 120/208 VAC 3 phase and 120/240 VAC single-phase systems
5. Yellow – Building Management and Control System - BMCS
6. White - Security and Surveillance equipment circuits

S. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example “MSB to Panel HA”). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example “LA2” referring to Panel LA sec. 2 is to be listed as “LA”). Label covers for special applications explaining contents (example “Emerg. Gen. Annunciator controls”, “IDF ground”). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example “Not Used Panel LA”. Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.

T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

U. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.

V. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.

W. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.

X. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.

Y. Use stamped steel bridges to fasten flush mounting outlet box between studs.

Z. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.

AA. Use adjustable steel channel fasteners for hung ceiling outlet box.

BB. Do not fasten boxes to ceiling support wires.

CC. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.

DD. Use gang box where more than one device is mounted together. Do not use sectional box.

EE. Use gang box with plaster ring for single device outlets.

FF. Support outlets flush with suspended ceilings to the building structure.

GG. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.

HH. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.

II. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.

JJ. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.

KK. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.

LL. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.

MM. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.

NN. Bond equipment grounding conductor to all junction and pull boxes.

OO. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.

PP. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.

QQ. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

3.2 ADJUSTING

A. Adjust flush-mounting outlets to make front flush with finished wall material.

B. Install knockout closures in unused box openings.

END OF SECTION 26 05 37

SECTION 26 05 38 ELECTRICAL FLOOR BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical floor box and fitting work as required, scheduled, indicated, and specified.

B. All floor boxes and all poke-throughs for line voltage wiring devices or telecommunication outlets shall be the concealed service type.

1.2 QUALITY ASSURANCE

A. UL Label: Electrical boxes, covers, and fittings shall be UL listed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products that are Buy American Act Compliance

A. Wiremold

B. Hubbell

2.2 CONCEALED SERVICE - FLOOR BOXES

A. Wiremold Evolution RFBA 4/6/10 Series

B. Floor box shall be electro-galvanized sheet steel with fusion-bonded epoxy suitable for direct contact with concrete on grade.

C. Cover assembly shall die-cast aluminum, finish as selected by Architect.

D. Shall deliver electric power and telecommunications from non-proprietary building standard wiring devices and non-proprietary building standard telecommunications ports installed below the surface of the floor.

E. Shall deliver telecommunications without interference from the electric power delivery.

F. Hinged cover shall accept carpet or tile to match floor covering and be 180 degrees reversible.

G. Shall accept conduit sizes up to 2-inches.

H. When hinged cover is closed and no services in place, device shall have no obstructions above surface of floor.

2.3 CONCEALED SERVICE, FIRE RATED, POKE-THROUGH DEVICE

A. Wiremold Evolution Series - 6AT (3-gang) / 8AT (5-gang) /10AT (8-gang)

B. Shall be UL classified two-hour fire rating. Where floor fire rating is three-hour, provide only the 6AT series with a 3-hour fire rating.

C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign materials.

D. Shall deliver electric power and telecommunications from non-proprietary building standard wiring devices and non-proprietary building standard telecommunications ports installed below the surface of the floor.

D. Center data channel for six-inch 6AT poke throughs shall accept a minimum of (22) Category 6a cables, center data channel shall accept a minimum of (5) Category 6a cables.

E. Shall be installed in a single core drilled hole.

F. Shall permit use with “H” cut opening in carpet so carpet can be restored if position is vacated

G. Shall have interchangeable service fitting accessories including hinged guard and low voltage communication inserts

H. Service fitting cover shall be aluminum, finish as selected by Architect.

2.4 RECESSED FURNITURE FEED POKE-THROUGH DEVICES

A. Wiremold Evolution 6ATCFF Series.

B. Shall be UL classified for use in up to two-hour fire rated floors.

C. Shall be UL listed for use with power and low voltage in a single service fitting and shall protect against ingress of water or foreign materials.

D. Shall be installed in a single core drilled hole

E. Die-cast aluminum covers, finish as selected by Architect.

2.5 SERVICE FITTING HEADS

A. Shall be brushed aluminum or stainless steel.

B. Shall deliver electrical power from receptacles as designated on the plans.

C. Shall deliver telephone/data through precut bushed opening

D. Provide non-proprietary building standard line voltage wiring devices

E. Shall be furnished standard with conduit nipple for direct screw threading into cover assembly

PART 3 - EXECUTION

3.1 GENERAL

A. Locate position for floor boxes and runs of conduit as shown on the plans, or as required. Coordinate with the Structural Engineer and Architect for dimensional locations of floor boxes prior to cutting or pouring slab.

B. Select appropriate size of floor boxes, poke-through, or multiple services floor boxes for quantity of wiring devices or cables indicated and as recommended by manufacturer.

3.2 INSTALLATION

A. Position floor boxes and install conduits at locations approved by the Architect.

B. After concrete pour, pull wires and install devices according to manufacturer's recommendations.

C. Activate in accordance with the National Electrical Code.

D. Coordinate with floor covering contractor to complete installation.

E. Core drill openings for poke-through service fitting and installation in accordance with manufacturer's instructions and where approved by the Structural Engineer and Architect.
1. Minimum spacing of 2-feet on center and not more than one unit per each 65-square feet of floor area in each span as required by Fire Resistance Directory.

END OF SECTION

SECTION 26 05 40 ELECTRICAL GUTTERS AND WIREWAYS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide electrical gutter work as shown, as specified and as required.

B. Application: The types of electrical gutters required for the project include the following:
1. Electrical wiring gutters
2. Voice / Data / Video / Communication and signal distribution wireway

1.2 QUALITY ASSURANCE

A. UL Label: Gutters and wireways shall be UL labeled.

PART 2 - PRODUCTS

2.1 ELECTRICAL GUTTERS AND WIREWAYS

A. General: Provide hinged electrical gutters and wireways in the types and sizes indicated or required, minimum 16 gauge thickness, with rounded edges and smooth surfaces; constructed in compliance with applicable standards; with features required.

B. Size: Provide size indicated. Where size is not indicated, construct in accordance with the NEC and other standards. Gutters shall be of manufacturer’s standard lengths, without field cutting or field extensions.

C. Accessories: Provide gutter and wireway accessories where indicated, constructed of same metal and finish as gutters or wireways.

D. Supports: Provide gutter and wireway supports indicated, conforming to NEC, and as recommended by the manufacturer, and as specified in Section 26 05 33 Conduit Systems.

E. Materials and Finishes: NEMA 1 gutters and wireways shall have gray powder coat finish over galvanized steel. Gutters and wireways installed outside shall be NEMA 3RX minimum. Gutters or wireways installed within 100-feet of cooling towers, at kitchen or food preparation areas, and natatorium, spa or therapy pool areas shall be of 304 stainless steel NEMA 4X construction.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide gutters and wireways only where specified or required. Use of gutters and wireways shall be kept to a minimum.

B. Finishing: Remove burrs and sharp edges of gutters and wireways wherever they could be injurious to conductor insulation or jacket.

C. Installation: Install gutters and wireways where shown or required, in accordance with the manufacturer's written instructions, NEC, NECA "Standard of Installation," and with recognized industry practices to ensure that the gutters and wireways comply with the specified requirements. Comply with requirements of NEMA and the NEC pertaining to

installation of electrical gutters.

D. Grounding: Electrically ground gutters and wireways to ensure continuous electrical conductivity. Provide equipment grounding conductor.

E. Conductors:
   1. Complete gutter and wireway installation before starting the installation of conductors.
   2. Provide sufficient space to permit access for installing, splicing, and maintaining the conductors.

F. A maximum of 12 conduits containing branch circuits shall be allowed to be installed in any gutter or wireway.

END OF SECTION 26 05 40

SECTION 26 05 50 FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nelson

B. 3M (Minnesota Mining Manufacturing)

C. Hilti

D. Specified Technologies, Inc.

E. Metacaulk

2.2 MATERIAL AND COMPONENTS

A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).

B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION 26 05 50

SECTION 26 08 00 ELECTRICAL COMMISSIONING COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section outlines commissioning requirements and activities of the Contractor, Owner, CxA and Design Professionals as related to the Division 26 Electrical.

B. Related Sections:
1. Division 01 – General Requirements and Specification Section 01 91 13, General Commissioning
2. Division 22 – Plumbing
3. Division 23 – Mechanical
4. Division 26 – Electrical
5. Division 27 – Communications
6. Division 28 – Safety and Security

1.2 DEFINITIONS

A. Refer to Specification Section 01 91 13, General Commissioning for definitions.

1.3 CONTRACT INFORMATION

A. The Owner will contract directly for commissioning services.
1. Commissioning Agent fee will be paid for directly by the Owner.
2. Contractor shall provide coordination with the CxA including but not limited to labor, materials, and testing equipment as required for the CxA as specified in this section.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. Contractor shall provide all standard and specialized testing equipment required to perform Start-up and Functional Performance Testing. Test equipment and other items required for Functional Performance Testing includes but not limited to those listed below. Data logging and software required for testing and corrective measures as required by the contract documents shall be provided by the Contractor.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. Calibration tags shall be affixed or certificates readily available.

2.2 OTHER CONTRACTOR PROVIDED EQUIPMENT:

A. Ladders and/or lifts and appropriate fall protection as required by Contractor and the CxA.

PART 3 - EXECUTION

3.1 COORDINATION - GENERAL

A. Except for the activities to be performed by the CxA called for herein, all component and system installation work required by the Division 26 specifications, including specific contractor provided or furnished items indicated by this Section, shall be provided by the

Contractor.

3.2 SUBMITTALS

A. Electrical:
1. Lighting controls and lighting equipment submittals conforming to the contract documents.

3.3 EQUIPMENT START-UP

A. Notification:
1. Contractor shall provide ten Owner business day notice to CxA, Owner and Design Team of start-up dates. Owner business days are defined as the Owner's Construction and Maintenance Operations department's normally scheduled work days, typically Monday through Friday, excluding Federal, State, Local, and Owner scheduled Holidays.

B. Prior to start-up, Contractor shall:
1. Verify that equipment and systems are complete, accessible, correctly connected and ready for operation. Perform all pre-start inspections and tests as called for in Division 26 and as recommended by the equipment manufacturer.
2. Pre-start requirements of the manufacturer shall include but not limited to the Contractor's completed applicable documentation and completed inspection and check-list.
3. Complete applicable sections of Pre-functional Checklists (PFCs).
4. Coordinate start-up attendance by manufacturer or their authorized representative as required by the specifications and the manufacturer.

C. At start-up, Contractor shall:
1. Supervise the activities of the manufacturer's authorized start-up technician and/or authorized manufacturer's representative.
2. Verify proper voltage, overcurrent protection, phase, phase sequence, and any other conditions that may cause damage if not correct.
3. Execute start-up under supervision of contractor personnel familiar with the installation and operation of equipment being commissioned and the equipment manufacturer's personnel in accordance with the manufacturer's instruction.
4. Complete manufacturer start-up requirements and documentation. Provide a copy of documentation to the CxA for inclusion in the Cx Manual.
5. Complete PFC's and provide documentation to CxA.
6. Provide documentation of any issues and noted during start-up to CxA, Owner and Design Team. Outline recommendations for corrective action to comply with the Contract Documents and equipment manufacture's installation and operation requirements.

3.4 PRE-FUNCTIONAL CHECKLISTS

A. Contractor shall forward completed copies of PFC's to the CxA for inclusion into the Cx documentation. PFC's will be provided by the CxA. If approved by the Cx as an alternate, contractor may submit alternate versions of the PFC's to the CxA for review and comment.

B. Contractor shall complete PFC for each of the following equipment:
1. Electrical.
a. Electrical systems
b. Lighting and lighting controls.

3.5 FUNCTIONAL TESTING

A. General:
   1. Contractor shall organize and schedule Contractor Team members to execute the functional testing, which will be directed by CxA.
      a. Lighting and lighting controls.

END OF SECTION 26 08 00

SECTION 26 09 25 ELECTRICAL CONTACTORS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Miscellaneous electrical contactors as shown, required, scheduled, and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by one of the following:
Schneider Electric - Square D
ABB-General Electric
Siemens
Eaton

2.2 CONTACTORS

A. Provide contactors as shown, required, and specified. The number of poles, ampere-ratings, and pole arrangements shall be as required. Contactors shall conform to the following:
1. Rated for continuous duty at full rated current in an unventilated enclosure. Eight-hour duty ratings are not acceptable.
2. Contacts shall be readily replaceable, self-aligning, silver alloy.
3. Load contactors shall be rated for not less than 30A continuous rating. Auxiliary contacts shall be rated for not less than 10 amperes.
4. Contactors rated for lighting and mixed loads shall have an interrupting capacity of 150% of their continuous duty rating.
5. Contactors shall be capable of successfully handling inrush currents at 20 times rating.
6. Provide a minimum of two spare load contacts on each individual contactor rated 60A or less for future use.

B. Electrically-held Devices shall conform to the following:
1. AC operated units shall have laminated low loss electrical steel core pieces with machine ground pole faces and shading coils.
2. Units rated at 300A and above shall have DC operating coils and include the necessary rectifier for the AC/DC operation.
3. Normally open contactors shall be spring-loaded open and magnetically closed.
4. Contactors for emergency lighting or power shall be normally closed.

C. Controls: Individual contactors operated by automatic controls shall have 30.5mm HAND-OFF-AUTOMATIC switches, otherwise provide HAND-OFF switches. Contactor controls shall be mounted in the contactor enclosure cover. Contactors serving receptacle loads controlled by local switching shall not have Hand-Off-Auto nor Hand-Off switching.

D. Control Power. Provide dedicated 120-volt circuit for contactor control power and indicator pilot lights. Do not use same circuit feeding load.

E. Enclosure:
1. Contactors and control enclosures installed in indoor locations shall be NEMA 1 heavy-duty enclosures unless shown otherwise.

2. Contactors and control enclosures installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

F. Minimum interrupting rating shall be 35KAIC.

PART 3 - EXECUTION

3.1 INSTALLATION OF MISCELLANEOUS ELECTRICAL CONTROLS

A. Provide electrically held contactors, with line side wiring complete, in accordance with the National Electrical Code and manufacturer's recommendations.

B. Fuses: Install fuses where coil control power is fed from line side of contactor.

C. Adjustment: Adjust operating mechanisms for free mechanical movement.

D. Coordinate contactor control and operation requirements with the Building Management Control System.

E. Identify each contactor as specified in Section 26 05 00.

F. Contactors shall not be installed above ceiling and shall be readily accessible. Locate contactors in same room as panelboard serving the load unless otherwise indicated.

3.2 INTERIOR AND EXTERIOR LIGHTING CONTROL

A. Parking lot lighting, building mounted exterior lighting, and exterior signage shall be controlled by separate lighting contactors by the specified Building Management and Control System. Interior lighting as noted on the plans shall be controlled as noted on the plans and as specified by the Building Management and Control System. Contractor shall circuit all systems to be controlled by the Building Management and Control System through contactors compatible with system controls and shall ensure the control and operation of lighting control system is complete.

B. Provide mechanically held contactors where control is three-wire, momentary control signal.

C. Provide electrically held contactors where control is two-wire, constant control signal for open or close.

D. Provide normally closed contactors for emergency lighting and power circuits where contactors are indicated or required.

E. Provide normally closed contactors for circuits controlled by "emergency power off" or teacher control switches in science classrooms, computer labs, and vocational instructional areas.

F. Provide control contactors and cabling for bi-level or tri-level LED drivers. Bi / tri level control contactors for exterior lighting shall be controlled by the Building Management Control System, with local BMCS manual override for both "ON" and "HIGH" settings. Bi / tri level controls for interior lighting shall be controlled by occupancy sensors and local control switch.

END OF SECTION 26 09 25

SECTION 26 09 29 DIGITAL LIGHTING CONTROLS

PART 1 - GENERAL

1.1 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. The Contractor shall coordinate all of the work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system.

B. Contractor shall provide to the digital lighting control equipment manufacturer all quantities for system including but not limited to network hardware, room controllers, occupancy sensors, button stations, photocells, emergency lighting controllers, and wire lengths for room controller communications bus.

C. Contractor shall demonstrate to the Owner, the complete successful operation of system including but not limited emergency lighting operation. Demonstration shall occur a minimum of 30 days prior to the contract scheduled completion date. Installing electrical contractor shall replace any failed material during warranty period of one year at no additional cost to the Owner.

D. Refer to the drawings and other specifications in Division 23 and 26 regarding lighting controls for exterior lighting and other interior areas indicated for control by the Building Management Control System (BMCS) or other means other than the digital lighting controls specified in this section. Provide 8-hours of dedicated programming and instruction time of factory trained personnel with the BMCS contractor and Owner for BMCS integrating or interfacing with the lighting control system.

E. Factory startup and commissioning for substantial completion, 90-day verification re-commissioning, and 11-month close-out commissioning shall be provided.

F. Coordinate with Owner for exact location of lighting control hard wire connection for lap-top computer for programming. This hard-wired connection shall only be required for programming and commissioning. The lighting control system shall not be integrated or interfaced, nor reside on or with the building's data network unless specifically requested and supervised by the Owner.

1.2 QUALITY ASSURANCE

A. Component Pre-testing: All components and assemblies are to be factory pre-tested and burned-in prior to installation.

B. NEC Compliance: Comply with NEC as applicable to electrical wiring work.

C. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

1.3 SYSTEM DESCRIPTION & OPERATION

A. The lighting control system as defined under this section covers the following equipment for local room or local area networks only. Building wide network equipment is required.
   1. Digital Room Controllers – Self-configuring, digitally addressable relay controllers with 0-10-volt dimming control for lighting and single relay application-specific

plug load controllers when plug load control is specified or required.

2. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
3. Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
4. Digital Photosensors –Single-zone closed loop and multi-zone open loop daylighting sensors with two-way active infrared (IR) communications that can provide switching or dimming control for daylight harvesting.
5. Configuration Tools – Smart phone applications (app) or handheld remote for room configuration provides two-way communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Simple user interface and allow sending and receiving of room variables and store of occupancy sensor settings.
6. Emergency Lighting Control Unit (ELCU) – allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.
7. The DLM lighting control system components shall be configured as a fully wired network. DLM building wide network shall interface with the Building Management Control System (BMCS) at a central location or hub for a single BMCS interface point. The DLM lighting control system shall provide the BMCS with an occupied or un-occupied state based on occupancy/vacancy status of each room or area zone controlled by the room controller.

B. Lighting controls and automation for exterior lighting and interior areas not controlled by the system specified in this section shall be as required and as specified by other specification sections in Division 23, and 26.

C. Power and communications for lighting controls provided shall be wired. Use of batteries or wireless communications is prohibited. Dimming control wiring shall not be installed with any line voltage power wiring conduits.

1.4 SUBMITTALS

A. Submit the specification line-by-line compliance review, shop drawings, and the product data specified below under one cover as a complete submittal.
1. Specification compliance review: refer to Electrical Shop Drawings specification section for instructions and additional information.
2. Shop Drawings:
   a. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
   b. Scale drawing for each area showing the exact location of each sensor, room controller, and digital switch.
3. Product Data: Catalog sheets, specifications, and installation instructions.
   a. Include data for each device which:
   b. Indicates where sensor is proposed to be installed.
   c. Prove that the sensor is suitable for the proposed application.

1.5 WARRANTY

A. Provide a five-year complete manufacturer’s warranty on all products to be free of manufacturers’ defects.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Lighting Control System Manufactures:
1. Legrand North America – Wattstopper (basis of design)
2. Acuity Brands - n-Light
3. Cooper Lighting Solutions – Greengate
4. Lutron - Athena

B. Key switches: provide heavy duty switch of the type required for specified sequence of operation. Lock cylinder shall utilize building standard Leviton #WS-35 keys, the same as required for line voltage key switches specified in Line Voltage Wiring Device specifications:
1. Lighting Control System manufacture listed above for momentary type operation.
2. Leviton for toggle ON/OFF.

2.2 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Ceiling mounted (or where specifically indicated or required to be wall mounted to suit installation); passive infrared (PIR), ultrasonic, or dual technology (passive infrared and ultrasonic) digital occupancy sensor. Furnish the system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

B. Digital Occupancy Sensors shall provide graphic display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton programming for the following variables:
   a. Sensitivity – 0-100% in 10% increments
   b. Time delay – 1-30 minutes in 1-minute increments
   c. Test mode – Five second time delay
   d. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   e. Walk-through mode
   f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
2. One or two RJ-45 port(s) for connection to DLM local network.
3. Transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
4. Device Status LEDs including:
   a. PIR Detection
   b. Ultrasonic detection
   c. Configuration mode
   d. Load binding
5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
6. Manual override of controlled loads.

C. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required.

2.3 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configurations; grey, compatible with building standard stainless-steel wall plates with decorator opening.

Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Red configuration LED on each switch that blinks to indicate data transmission.
4. Blue Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

B. Two RJ-45 ports for connection to DLM local network.

C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching.

D. The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2. Individual button function may be configured to toggle, ON only or OFF only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.
6. Switch buttons may be bound to any load on a room controller and are not load type dependent; each button may be bound to multiple loads.

2.4 ROOM CONTROLLERS

A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers shall be simple to install and shall not have dip switches, potentiometers or require special configuration. The control units shall include the following features:

1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
2. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.
3. Device Status LEDs to indicate:
   a. Data transmission
   b. Device has power
   c. Status for each load
   d. Configuration status
4. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable
5. Plenum rated
6. Manual override and LED indication for each load

7. Dual voltage (120/277 VAC, 60 Hz)
8. Zero cross circuitry for each load.

B. ON/OFF/Dimming enhanced Room Controllers shall include:
1. Real time current monitoring
2. One, two or three relay configurations
3. Efficient 250 mA switching power supply
4. Four RJ-45 DLM local network ports.
5. One 0-10-Volt analog output per relay for control of compatible LED drivers.
6. The following dimming attributes may be changed or selected using a wireless configuration tool:
   a. Establish preset level for each load from 0-100%
   b. Set high and low trim for each load
7. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
   a. One relay configuration only
   b. Automatic-ON/OFF configuration

2.5 DIGITAL PHOTOSENSORS

A. Digital photosensors work with room controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to a room controller. Closed loop photosensors measure the ambient light in space and control a single lighting zone. Open loop photosensors measure incoming daylight in space and are capable of controlling up to three lighting zones. Photosensors shall be interchangeable without the need for rewiring.

B. Digital photosensors include the following features:
1. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve. The photodiode shall not measure energy in either the ultraviolet or infrared spectrums. The photocell shall have a sensitivity of less than 5% for any wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Sensor light level range shall be from 1-10,000 footcandles (fc).
3. The capability of switching one-third, one-half or all lighting ON and OFF, or raising or lowering lighting levels, for each controlled zone, depending on the selection of room controller(s) and load binding to room controller(s).
4. For switching daylight harvesting, the photosensor shall provide a deadband or a separation between the “ON Setpoint” and the “OFF Setpoint” that will prevent the lights from cycling after they turn off.
5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a user-selectable minimum level.
6. Programmable wall switch override to allow occupants to reduce lighting level to increase energy savings or raise and lower lighting levels for a selected period of time or cycle of occupancy.
7. Infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
8. Configuration LED that blinks to indicate data transmission.
9. Status LED indicates test mode, override mode and load binding.
10. Recessed switch to turn controlled load(s) ON and OFF.
11. An adjustable head and a mounting bracket to accommodate multiple mounting methods and building materials. The photosensor may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox.

C. Closed loop digital photosensors include the following additional features:
   1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
   2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
   3. Automatically establishes setpoints following self-calibration.
   4. A sliding setpoint control algorithm for dimming daylight harvesting with a “Day Setpoint” and the “Night Setpoint” to prevent the lights from cycling.

D. Open loop digital photosensors include the following additional features:
   1. An internal photodiode that measures light in a 60-degree angle cutting off the unwanted light from the interior of the room.
   2. Automatically establishes setpoints following calibration using a wireless configuration tool or a PC with appropriate software.
   3. A proportional control algorithm for dimming daylight harvesting with a “Setpoint” to be maintained during operation.

2.6 ROOM OR AREA NETWORK

A. The DLM local network shall be a free topology lighting control physical connection and communication protocol. Digital room devices connect to the network using low voltage cables which provide both data and power to room devices. The DLM local network shall include:
   1. Plug n’ Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
   2. Simple replacement of any device in the network with a standard off-the-shelf unit without requiring commissioning, configuration or setup.
   3. Push n’ Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
   4. Two-way infrared communications for control by handheld remotes where indicated, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30-feet from a sensor, wall switch or IR receiver.

2.7 BUILDING WIDE NETWORK

A. The DLM lighting control system components shall be configured as a fully wired network.
   1. The DLM building wide network shall interface with the Building Management Control System (BMCS) at a central location or hub for a single BMCS interface point. The DLM lighting control system shall provide the BMCS with an occupied or un-occupied state based on occupancy/vacancy status of each room or area zone controlled by the room controller.
   2. Simple replacement of any device in the network with a standard off-the-shelf unit without requiring commissioning, configuration, or setup.
   3. Provide all hardware (except for Owner provided laptop or PC), software, GUI setup, programming, commissioning, and Owner training.

2.8 CONFIGURATIONS TOOLS

A. A configuration tool facilitates optional customization of DLM local networks and is used to set up open loop daylighting sensors. A wireless configuration tool features infrared

communications, while PC software connects to each local network via a USB interface.

B. Features and functionality of the wireless configuration tool shall include:
1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30-feet.
2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
3. Read, modify and send parameters for occupancy sensors, daylighting sensors, room controllers and buttons on digital wall switches.
4. Save up to nine occupancy sensor setting profiles and apply profiles to selected sensors.
5. Temporarily adjust light level of any load(s)on the local network and incorporate those levels in scene setting.
6. Adjust or fine-tune daylighting settings established during auto-commissioning and input light level data to complete commissioning of open loop daylighting controls.

2.9 EMERGENCY LIGHTING

A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF/Dimming control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting to full bright ON until normal power is restored. Features include:
1. 120/277 volts, 50/60 Hz., 20-amp driver rating
2. Push to test button
3. Auxiliary contact for remote test or fire alarm system interface.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION:

A. Install the work of this Section in accordance with manufacturer’s printed instructions unless otherwise indicated. Provide a minimum of eight hours of on-site technical support for the coordination between the BMCS and the lighting controls system. Ensure that the sequences of operation involving the BMCS are fully operational as specified and as required.

B. The installing contractor shall, prior to request factory start up and site commissioning, request an on-site meeting by including local factory representative, Owner and the general contractor, to assist in identification of any open-ended issues, thereby eliminating potential for delays and system commission interruptions.

C. Upon confirmation of progress by local factory authorities, the installation electrical contractor shall complete the start-up request forms provided by the manufacturer, including any field changes from the contract documents. This is essential to facilitate substantial completion.

D. Room controllers shall be installed so that they are easily accessible for replacement or maintenance:
1. Mount lighting control equipment to junction boxes as recommended by the manufacturer.
2. Where accessible ceiling heights are 10-feet AFF or less, room controllers shall be mounted on wall above local control switch location between 4 and 18-inches above the accessible ceiling and 2-inches clear of T-grid for above ceiling

access.

3. Where ceiling heights are above 10-feet, room controllers shall be mounted in an ancillary area above the ancillary area local control switch location with accessible ceiling of 10-feet or less. The high ceiling room controller shall be mounted adjacent to the lower ceiling room controller serving the ancillary area. The room controller for the high ceiling and ancillary area(s) may utilize the same room controller for each area if practical. If an ancillary area with low accessible ceiling area is not available, the room controller shall be installed in the same mechanical or electrical room as the electrical panel serving the lighting for that area and clearly labeled for its use and specific room that it controls.
4. Smaller ancillary spaces not separated by doors that adjoin the larger space do not require an additional control zone and shall be controlled with the larger adjoining space zone to reduce complexity.

E. Building wide network hardware shall be installed so that it is easily accessible for programming, replacement, or maintenance. Verify exact location with Architect/Owner prior to installation. Coordinate with Owner for direct connection to Owner's data network if desired by Owner.

F. Lighting controls shall meet the minimum requirements of all local codes when the project is permitted with whatever exceptions or additional requirements deemed appropriate by the Owner. Wherever possible, minimize the complexity of the controls design to reduce the quantity and types of required sensor hardware, low voltage, and line voltage wiring:
1. Provide UL 924 emergency load control devices so that designated emergency interior light fixtures will be controlled ON/OFF/dimmed with adjacent area lighting and be brought to full-bright ON during power failure.
2. Provide full floor area occupancy/vacancy sensor coverage wherever sensors are required.
3. Provide 20-miniute time out delay where vacancy sensor control is provided or required.
4. Provide 20-miniute or IECC maximum time out delay, whichever is shortest, where occupancy sensor control is provided or required.

G. Where daylighting controls are required or indicated they shall be fully automatic and full range dimming without local user overriding of the daylighting maximum light level set point or trim level. Local user override to dim to OFF shall be provided. A single photo sensor shall be interfaced with the room controller for each daylighting zone in an area and for each cardinal direction as required by the IECC, and as recommended by the lighting control system vendor.

H. Low voltage cabling installed above ceiling shall be supported every 5 feet using J-hooks or D-rings at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling shall hang plumb to devices. Low voltage control wiring shall not be installed in the same raceway with line voltage wiring.

I. Renovation areas: Utilize existing wall box switch locations where line voltage wiring is removed and therefore can be utilized for low voltage control controls and control cabling unless shown or noted otherwise.

3.2 GENERAL SEQUENCES OF OPERATION

A. Areas with lighting that requires dimming: Manual ON shall initially bring the lighting level to lighting control system 80-percent set point but not lower than the minimal Owner

design standard-maintained foot-candela light level for the type of space served. Refer to Owner's construction standards for required maintained light levels. Contractor/vendor shall verify in the field with Owner during the commissioning process typical acceptable light levels with all ceilings and walls installed and with final paint and finishes applied. It is the Owner's intention to adjust the trim points to a minimally acceptable light level and only adjust as needed due to light fixture lumen depreciation over the lifetime of the light fixtures. This will increase energy savings and extend the lifetime of the lighting system.

3.3 SEQUENCES OF OPERATION FOR SPECIFIC AREAS – REFER TO PLAN DETAILS FOR ADDITIONAL PROJECT SPECIFIC INFORMATION AND INSTRUCTIONS

A. CORRIDORS, STUDENT AND PUBLIC TOILETS/RESTROOMS ACCESSIBLE DIRECTLY FROM CORRIDORS, AND STAIRS: Includes all hallways and other egress pathways, including attached open access without doors, ancillary spaces such as flex or collaboration spaces, student and public toilets/restrooms with or without a door open to corridor, (This does not include large areas open to the corridor pathway such as the adjoining seating areas of cafeteria, dining, commons, nor shall it include administrative staff toilets or restrooms).

1. Control through BMCS. BMCS occupied (turn ON) or unoccupied (turn OFF) state sent to DLM room controllers. Single DLM occupancy sensor and key switch at each security keypad. Sensor to be used for auto ON only; sensor shall not turn corridor lights OFF. Dimming only if required for code required daylight harvesting.
2. Provide DLM occupancy sensor for body movement detection in corridors (maximum spacing 50-feet) to only turn all corridor lights ON. Provide hand motion sensor coverage in adjoining toilets/restrooms. Provide a DLM momentary SPDT key switch next to each security keypad to manually turn corridor lights ON only (to be used if there is a DLM sensor failure or BMCS failure or if BMCS is in un-occupied state). Key switch shall not turn lights OFF. Any corridor occupancy sensor shall trigger all corridor DLM room controllers to turn lights ON at any time of day and will remain ON until a BMCS unoccupied state in which the lights shall turn OFF.
3. Corridors and their attached open access ancillary general use spaces and attached student/public toilets with or without corridor doors shall be grouped together. Do not switch general use ancillary spaces including student/public toilets with or without doors separately from the corridor that have direct access from an adjoining corridor.
4. Flex or collaboration spaces open to corridors shall be a separate dimming control zone but shall be grouped with the adjoining corridor's occupancy sensors and BMCS control for BMCS ON/OFF and sensor ON.
4. Corridor SPDT key switch shall be located at each security system control keypad and shall have both load terminals shunted so that either up or down position will turn the lights ON. Label key switches as "CORRIDOR LTG ON".
5. Do not provide a fire alarm interface since sensors do not turn lights OFF.
6. DLM locations and quantities shall be kept to a minimum. Multiple corridors shall be grouped and controlled together as much as practical. Individual corridors do not require individual local controls. All corridors are either all on or all off.
7. Lighted display cases in corridors: Circuit with corridor lighting and with additional local manual line voltage key switch required by IECC identified as "CASE LTG".
8. Provide separate local switching or dimming for open ancillary flex spaces only if indicated.
9. No light switches in enclosed stairs. Switch and control all stair floor landings with the first-floor corridor except that one or more light fixture at each floor landing shall be controlled with that respective floor's corridor lighting. Do not provide sensors in stairs. Un-enclosed stairs shall be considered an extension of the

adjoining corridor or space and shall share the adjoining corridor or space-controlled lighting line voltage circuits/zone. Do not provide a separate zone for un-enclosed stairs open to adjoining spaces.

B. INSTRUCTION AND ADMINISTRATIVE AREAS, OFFICES, LOUNGES/BREAK ROOMS, COPY/PRINT ROOMS, AND SIMILAR AREAS, STORAGE ROOMS THAT ARE 100 SQUARE FEET AND LARGER.
1. SEQUENCE: Provide vacancy sensor control (DLM system manual ON/OFF, auto OFF, DIM).
2. Instructional areas, classrooms, and large group instruction up to 99-person occupancy provide single zone dimming with DLM control at each entry door. Provide additional zones if the room is equipped with room divider partitions.
3. Large Group Instruction over 100-person occupancy: Provide up to three dimming zones, one over the presentation display area, one over the seating area, and one for any other specialty lighting or enhanced zone functionality. Provide DLM system master control station only at the main entry door or near the presentation area. Provide entry station(s) at each entry door to provide ON/OFF general lighting.

C. SHOPS, KITCHEN, FOOD SERVING QUEUE, AND NATATORIUM
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights off. No occupant sensors for safety and security. Local DLM switches also function as a local override. No dimming
2. Kitchen/serving: Manual local DLM switches. Locate kitchen/serving switches in supervised locations for on/off control. No dimming (health code lighting requirement supersedes IECC).
3. Shops: Provide lighting with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls or dimming.
4. Natatorium: Manual local DLM momentary SPDT toggle (not keyed) switch in supervised location. Manual local DLM momentary SPDT key switch at main entry door(s) and un-supervised locations. No dimming, no daylight harvesting for safety and security.

D. CAFETERIA, CAFETORIUM, GYMS, LIBRARY, STAGE, LOCKER ROOMS
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights OFF. No occupant sensors for safety and security. Local DLM switches also function as a local DLM override. Dimming only as required for light reduction, code required daylight harvesting, and as indicated on drawings.
2. Cafeterias and cafetorium’s: DLM SPDT key switches at cafetorium main entry. Dimming switches at main entry and on stage. Cafeterias require only one dimming zone. Cafetorium with stage: Provide up to three dimming zones, zoned from front of house to back of house.
3. School stage general lighting: General lighting for stages and platforms with proscenium curtains or wall dividers shall be controlled as a separate zone. Provide a separate zone for back-of-house stage access ramps. Provide DLM ON/OFF control for the stage general lighting at each entry/exit points to the stage. Provide ramp lighting ON/OFF DLM control at each end of the ramp. Verify zoning and switch locations with theatrical consultant drawings.
4. Elementary School Cafetorium Theatrical Track Lighting: Locate four ganged wall box 120-volt line voltage dimmer controls on stage at an accessible location, not obstructed by stage curtains, as indicated or as directed by Owner.
5. Library: Manual DLM control located in supervised area (behind circulation desk or as directed by Owner). SPDT key switch at main entry door location as directed by Owner. If dimming zones are provided locate dimming controls in a

secured area (circulation desk). Key switch ON function shall force all lights to full bright.

6. Gyms: Manual DLM SPDT key switch. Provide separate zones with key switch to enable UIL competition light level for UIL Sports Lighting Standards. Label key switch for UIL competition light level control as court as “UIL COMPETITION ONLY”.
7. Locker rooms: Occupancy sensors control for auto ON/OFF: Set sensors to full-bright on and 20-minute time delay off for safety and security. Manual ON/OFF with DLM momentary SPDT key switches located at main entry doors and as directed by Owner. Provide lighting in these areas with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls.

E. CLOSED-DOOR ADMINSITRATIVE OR PRIVATE TOILETS/RESTROOMS, DRESSING ROOMS, OTHER TOILETS/RESTROOMS WITH DOORS NOT DIRECTLY CONNECTED TO A CORRIDOR:
1. SEQUENCE: Occupancy sensors (DLM system manual ON/OFF, automatic ON/OFF).
2. Provide dual technology occupancy sensor control for automatic ON/OFF based on occupancy. Set occupancy time delay and sensitivity to device setting maximum for safety and security.
3. Student/public restrooms with doors not connected to an adjacent egress corridor: Provide CFSID standard momentary key switch at student and public toilets/restrooms entry door location for manual DLM ON/OFF.
4. Private or administrative toilets/restrooms: Provide standard DLM ON/OFF switch for all other restrooms and dressing rooms with doors.

F. MECHANICAL, ELECTRICAL, PLUMBING, ELEVATOR, AND TECHNOLOGY ROOMS
1. Use safety and security exceptions to IECC. No BMCS, no sensors, no lighting reduction, no DLM, no dimming. Use Wattstopper 12-hour 120/277-Volt digital wall box timer with manual on/off, time-out visual flash and audio alarm. Multiple switch locations at each entry door, wired in parallel as required. Program for 12 hours.

G. CUSTODIAL, JANITORIAL, STORAGE LESS THAN 100SF, UTILITY ROOMS, FREE STANDING REMOTE BUILDINGS (CONCESSION, PRESS BOX, TICKETING, ETC.)
1. DLM vacancy sensor, no dimming except for press box viewing space.

H. BLACK BOX THEATRES
1. Black box theatres shall be provided with standalone instructional lighting, lighting controls and emergency lighting typical of instructional areas and classrooms.

3.3 SEQUENCES OF OPERATION FOR SPECIFIC AREAS – REFER TO PLAN DETAILS FOR ADDITIONAL PROJECT SPECIFIC INFORMATION AND INSTRUCTIONS

A. CORRIDORS AND STAIRS: Includes all hallways and other egress pathways, including attached open access without doors, ancillary spaces such as flex or collaboration spaces, student, and public toilets/restrooms with or without a door open to corridor, (This does not include large areas open to the corridor pathway such as the adjoining seating areas of cafeteria, dining, commons, etc.).
1. Control through BMCS. BMCS occupied (turn ON) or unoccupied (turn OFF) state sent to DLM room controllers. Single DLM occupancy sensor and key switch at each security keypad. Sensor to be used for auto ON only; sensor shall not turn corridor lights OFF. Dimming only if required for code required daylight harvesting.

2. Provide DLM occupancy sensor for body movement detection (maximum spacing 50-feet) to only turn all corridor lights ON. Provide DLM occupancy sensors for hand movement detection in adjoining toilets/restrooms, group with corridor sensors. Provide a DLM momentary SPDT key switch next to each security keypad to manually turn corridor lights ON only (to be used if there is a DLM sensor failure or BMCS failure or if BMCS is in un-occupied state). Key switch shall not turn lights OFF. Any corridor occupancy sensor shall trigger all corridor DLM room controllers to turn lights ON at any time of day and will remain ON until a BMCS unoccupied state in which the lights shall turn OFF.
3. Corridors and their attached open access general use ancillary spaces including student/public toilets with or without corridor doors shall be grouped together. Do not switch general use ancillary spaces including student/public toilets with or without doors separately from the corridor that have direct access from an adjoining corridor. Flex/Collaboration spaces open to corridors shall be a separate dimming zone grouped with the adjoining corridor's occupancy sensors and BMCS ON/OFF control.
4. Corridor SPDT key switch shall have both load terminals shunted so that either up or down position will turn the lights ON. Label key switches as "CORRIDOR LTG ON".
5. Do not provide a fire alarm interface since sensors do not turn lights OFF.
6. DLM locations and quantities shall be kept to a minimum. Multiple corridors shall be grouped and controlled together as much as practical. Individual corridors do not require individual local controls. All corridors are either all on or all off.
7. Lighted display cases in corridors: Circuit with corridor lighting and with additional local manual line voltage key switch required by IECC identified as "CASE LTG".
8. Provide separate local switching or dimming for open ancillary flex spaces only if indicated.
9. No light switches in enclosed stairs. Switch and control all stair floor landings with the first-floor corridor except that one or more light fixture at each floor landing shall be controlled with that respective floor's corridor lighting. Do not provide sensors in stairs. Un-enclosed stairs shall be considered an extension of the adjoining corridor or space and shall share the adjoining corridor or space-controlled lighting line voltage circuits/zone. Do not provide a separate zone for un-enclosed stairs open to adjoining spaces.

B. INSTRUCTION AND ADMINISTRATIVE AREAS, OFFICES, LOUNGES/BREAK ROOMS, COPY/PRINT ROOMS, AND SIMILAR AREAS, STORAGE ROOMS THAT ARE 100 SQUARE FEET AND LARGER.
1. SEQUENCE: Provide vacancy sensor control (DLM system manual ON/OFF, auto OFF, DIM).
2. Instructional areas, classrooms, and large group instruction up to 99-person occupancy provide single zone dimming with DLM control at each entry door. Provide additional zones if the room is equipped with room divider partitions.
3. Large Group Instruction over 100-person occupancy: Provide up to three dimming zones, one over the presentation display area, one over the seating area, and one for any other specialty lighting or enhanced zone functionality. Provide DLM system master control station only at the main entry door or near the presentation area. Provide entry station(s) at each entry door to provide ON/OFF general lighting.

C. SHOPS, KITCHEN, FOOD SERVING QUEUE, AND NATATORIUM
1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights off. No occupant sensors for safety and security. Local DLM switches also function as a local override. No dimming
2. Kitchen/serving: Manual local DLM switches. Locate kitchen/serving switches in

supervised locations for on/off control. No dimming (health code lighting requirement supersedes IECC).

3. Shops: Provide lighting with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls or dimming.
4. Natatorium: Manual local DLM momentary SPDT toggle (not keyed) switch in supervised location. Manual local DLM momentary SPDT key switch at main entry door(s) and un-supervised locations. No dimming, no daylight harvesting for safety and security.

D. CAFETERIA, CAFETORIUM, GYMS, LIBRARY, STAGE, LOCKER ROOMS

1. BMCS to interface with DLM room controllers for occupied/un-occupied state. Un-occupied state shall turn lights OFF. No occupant sensors for safety and security. Local DLM switches also function as a local DLM override. Dimming only as required for light reduction, code required daylight harvesting, and as indicated on drawings.
2. Cafeterias and cafetorium's: DLM SPDT key switches at cafetorium main entry. Dimming switches at main entry and on stage. Cafeterias require only one dimming zone. Cafetorium with stage: Provide up to three dimming zones, zoned from front of house to back of house.
3. School stage general lighting: General lighting for stages and platforms with proscenium curtains or wall dividers shall be controlled as a separate zone. Provide a separate zone for back-of-house stage access ramps. Provide DLM ON/OFF control for the stage general lighting at each entry/exit point to the stage. Provide ramp lighting ON/OFF DLM control at each end of the ramp. Verify zoning and switch locations with theatrical consultant drawings.
4. Elementary School Cafetorium Theatrical Track Lighting: Locate four ganged wall box 120-volt line voltage dimmer controls on stage at an accessible location, not obstructed by stage curtains, as indicated, or as directed by Owner.
5. Library: Manual DLM control located in supervised area (behind circulation desk or as directed by Owner). SPDT key switch at main entry door location as directed by Owner. If dimming zones are provided locate dimming controls in a secured area (circulation desk). Key switch ON function shall force all lights to full bright.
6. Gyms: Manual DLM SPDT key switch. Provide separate zones with key switch to enable UIL competition light level for UIL Sports Lighting Standards. Label key switch for UIL competition light level control as court as "UIL COMPETITION ONLY".
7. Locker rooms: Occupancy sensors control for auto ON/OFF: Set sensors to full-bright on and 20-minute time delay off for safety and security. Manual ON/OFF with DLM momentary SPDT key switches located at main entry doors and as directed by Owner. Provide lighting in these areas with less than 0.6-Watts per square foot for IECC exception to not require lighting reduction controls.

E. CLOSED-DOOR PRIVATE OR ADMINISTRATIVE TOILETS/RESTROOMS, DRESSING ROOMS, AND SIMILAR AREAS

1. SEQUENCE: Occupancy sensors (DLM system manual ON/OFF, automatic ON/OFF).
2. Provide dual technology occupancy sensor control for automatic ON/OFF based on occupancy. Set occupancy time delay and sensitivity to device setting maximum for safety and security.
3. Student/public restrooms with doors not connected to an adjacent egress corridor: Provide Owner standard momentary key switch at entry door location for manual DLM ON/OFF. Provide standard DLM switch for all other administrative or private restrooms and dressing rooms with doors.

F. MECHANICAL, ELECTRICAL, PLUMBING, ELEVATOR, AND TECHNOLOGY ROOMS
1. Use safety and security exceptions to IECC. No BMCS, no sensors, no lighting reduction, no DLM, no dimming. Provide Wattstopper 12-hour 120/277-Volt digital wall box timer with manual on/off, time-out visual flash and audio alarm. Multiple switch locations at each entry door, wired in parallel as required. Program for 12 hours.

G. CUSTODIAL, JANITORIAL, STORAGE LESS THAN 100SF, UTILITY ROOMS, FREE STANDING REMOTE BUILDINGS (CONCESSION, PRESS BOX, TICKETING, ETC.)
1. DLM vacancy sensor, no dimming except for press box viewing space.

H. BLACK BOX THEATRES
1. Black box theatres shall be provided with standalone instructional lighting, lighting controls and emergency lighting typical of instructional areas and classrooms.

3.4 IDENTIFICATION FOR LIGHTING CONTROL SYSTEM EQUIPMENT

A. Above ceiling lighting control system equipment locators: Provide plastic tape machine typed name plate to bottom of ceiling T-grid below relay location. White letters on black background with ¼” high letters on ½” tall label for digital lighting module indicate as: DLM.

B. Room controller identification: Label each digital room controller with 120/277 Volt circuit (i.e., “HD-27”) and room graphic name and number. Do not use architectural room name or number on drawings, use room graphic identification only.

3.5 ATTIC STOCK

A. Provide a minimum of 2 or 5 percent of the project total, whichever is greater, of all control hardware components used.

B. Where remote proprietary handheld programming tools are the only method used for programming, provide five configuration handheld remote tools for new facilities or three remote configuration handheld remote tools for renovation facilities.

3.6 FACTORY COMMISSIONING

A. The installing electrical contractor shall complete, prior to request of factory start up and site commissioning, complete installation of all devices, their respective loads landed and confirmed operations, switches installed, and confirmed operation of each and every local room network. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.

B. The installing electrical contractor shall provide a preliminary as-built drawing prior to commissioning. The drawings shall include room by room device ID’s and locations of all devices.

C. The factory commissioning shall include the following services. Programming of all button stations, configuration of all occupancy sensors and photocells. Verification of a complete working system. Configuration of the building wide network and interface with the Building Management Control System.

D. Provide written or computer-generated documentation on the commissioning of the

system including room by room description including:

1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
2. Sequence of operation, (e.g., manual ON, Auto OFF. etc.)
3. Load Parameters (e.g., blink warning, etc.)

E. The electrical contractor shall provide in writing, both the manufacturer and Owner, with 21-Owner business days written notice of the requested system startup and adjustment date.

F. The electrical contractor shall provide at least (1) journeyman electrician, familiar with the installation of the system, dedicated to assisting the factory start-up technician for the entire duration of the commissioning process.

G. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the Owner's personnel on the adjustment and maintenance of the system.

H. Re-commissioning – After 90 days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner’s Project Requirements. Provide a detailed report to the Architect / Owner of re-commissioning activity.

I. Close-out commissioning - After 11-months from substantial completion, re-calibrate sensor time delays and sensitivities to Owner’s Satisfaction at no additional cost to the Owner. Provide a detailed report to the Architect / Owner of re-commissioning activity.

END OF SECTION 26 09 29

SECTION 26 12 16 THREE PHASE, ENERGY EFFICIENT DRY-TYPE HARMONIC MITIGATING TRANSFORMERS (HMT) – 15kVA and Above

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included: Low voltage (less than 600 Volt) ultra-efficient harmonic mitigating transformer work as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

A. Standards: Transformers shall be designed and tested in accordance with NEMA and ANSI C33.4 and C89.2 standards.

B. UL Label: Transformers shall be UL labeled.

1.3 REFERENCE STANDARDS

A. UL-506

B. ANSI C75.11

C. NEMA ST-20

D. DOE 10 CFR Part 431, aka DOE 2016

1.4 WARRANTY

A. Minimum 10-year pro-rated parts replacement warranty.

1.4 SUBMITTALS

A. Include warranty information standard, outline and support point dimensions of enclosures and accessories, unit weight, voltage, kVA, impedance ratings and characteristics, no load core loss, full load winding conductor loss, full load losses, efficiency at 0, 25, 35, 50, 75 and 100 percent rated loads based on IEEE Standard 519-1992 Table 43 for non-linear load profile, percent regulation with 80 percent and 100 percent power factor loads, sound level at full load, tap configurations, insulation system type and rated temperature rise.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Powersmiths – T1000-30H-OPAL Series

B. Power Quality International – DV-Z4 Series

C. Mirus International – ULL-H1E Series

2.2 MATERIALS AND COMPONENTS

A. Except as otherwise indicated, provide transformer manufacturer's standard materials

and components as indicated by published product information, designed and constructed as recommended, and as required for a complete installation.

2.3 ENERGY EFFICIENT DRY-TYPE HARMONIC MITIGATING TRANSFORMERS

A. General: Indoor transformers shall be ultra-efficient with an average of 30% less losses than comparable DOE 2016 transformer efficiencies. Transformers shall be dry-type, NEMA Type 2 (ventilated-drip proof) enclosure, multiple-winding, rated as shown, and shall have manufacturer's standard impedance.

B. Construction: Transformer core shall be constructed of cold-rolled, oriented, high permeability silicon steel, either formed as a coil or laminated. Windings shall be copper, individual winding terminated with tin-plated copper bars, or wire electrically welded to the end of the windings, 10 kV BIL.

C. Windings: Transformer secondary windings shall be zigzag (0-degree or 30-degree phase shift or as indicated). The secondary windings shall provide for magnetic flux cancellation of the zero sequence (triplen) harmonic currents from non-linear loads connected to the transformer secondary. Triplen harmonic currents shall not appear on the current waveform of the transformer primary winding.

D. K-Rating: Minimum K-13 based on IEEE C57.110.

E. Taps: Transformers shall have six 2-1/2% taps, two above and four below nominal.

F. Temperature Rating: Transformers shall use an insulation system that has been temperature classified and approved by UL. Transformers shall have a maximum winding temperature rise of 115°C with an insulation system temperature classification of 220°C.

G. Accessories: Transformers shall have ground bus, 200% neutral bus, and full-length copper electrostatic winding shield, compression type lug terminations.

H. Load Rating:
1. Transformers shall be capable of operating at 120% of nameplate rating continuously while in an ambient temperature not exceeding 40°C.
2. Transformers shall be capable of meeting the daily overload requirement of ANSI C57.12.
3. Closed delta 120/240-Volt secondary, 3-phase, 4-wire with center tap neutral winding transformers:
   a. KVA rating indicated shall be for balanced 3-phase loading. Center tap winding shall allow for a maximum nominal 70-percent of three-phase kVA rating for unbalanced single phase neutral connected 120/240-Volt loads. The center tap winding shall be individually rated or constructed at twice the capacity of each of the other delta connected windings. (Example: a 225kVA rated center tap transformer would consist of two 75-kVA windings and one 150-kVA center tap winding).

I. Sound Rating: The transformer shall have sound levels lower than those ratings established in NEMA ST-20 and as shown in the following table. Sound ratings shall be measured in accordance with ANSI C89.91.

Transformer Rating (kVA) (600 Volt Class)	Maximum Sound Level Decibels
15 to 45	42
63 to 150	47

175 to 300	52
400 to 500	57
600 to 1000	61

J. Efficiency: Manufacturer's transformers shall exceed DOE 2016 efficiencies for standard dry-type transformers on average by a minimum 24% at 35% load of name plate load rating.

K. Impedance, minimum: 15-30 kVA 3.0%, 45 kVA and larger 3.5%.

L. Testing:
1. The manufacturer shall have tested each transformer for proper operation before shipment.
2. The manufacturer shall have performed the following additional tests on units identical to the design type being supplied. Furnish proof of performance of these tests in the form of test data sheets upon request:
   a. Sound levels.
   b. Temperature rise tests.
   c. Full-load core and winding losses.
   d. Percent regulation with 80 and 100% power factor load.
   e. Percent impedance.
   f. Exciting current.
   g. Insulation resistance.
   h. Non-linear load testing efficiency at 0, 25, 35, 50, 75 and 100% load under non-linear load profile based on IEEE C57.110.

PART 3 - EXECUTION

3.1 INSTALLATION OF TRANSFORMERS

A. General: Install transformers where shown, in accordance with the manufacturer's written instructions and industry practices to ensure that the transformers meet the specifications. Comply with requirements of NEMA and NEC standards, and applicable portions of NECA Standard of Installation, for installation of transformers. Transformers shall be floor mounted. Ceiling mounted transformers are not acceptable.

B. Dry-Type Transformer Mounting: Indoor, floor mount transformer on properly sized Amber/Booth Type RVD rubber-in-shear vibration isolators. Transformer enclosures shall make no contact with wall surfaces. Transformer enclosure shall be minimum 2-inches from rear wall and located to maximize working space in front of transformer.

C. Conduit: Conduit directly connected to transformer enclosures shall be flexible liquid tight conduit extending for a minimum of 18-inches and a maximum of 24 inches from transformer enclosure as measured along the conduit centerline. Include a ground wire, size in accordance with NEC, internal in each length of flexible conduit.

D. Grounding: Ground and bond transformers as a separately derived system unless noted otherwise, refer to NEC 250. Installation of bonding strap or bonding conductor between ground and neutral bus shall be witnessed by the Engineer prior to applying power and terminating secondary conductors. Ground transformer neutral to building steel or other nearest ground electrode as required by NEC 250 if building steel is not present.

3.2 TESTING

A. Insulation Tests: Before energizing, check transformer windings for continuity.

B. Winding Current: During initial no-load energizing, check current in each primary winding.

C. Tap Settings: Measure and record load current and voltage of transformers while loaded to verify proper transformer tap settings. Adjust tap settings to achieve or slightly exceed nominal secondary voltage at the transformer taps under no load. No load secondary tap voltage to ground shall not exceed 125 Volts for 120:208/240 systems and 290 Volts for 277/480 Volt systems when primary voltage is less than 5% over nominal.

D. Submittals: Furnish instruments and personnel required for tests. Submit four copies of certified test results to Engineer for review. Reports include transformer tested, date and time of tests, relative humidity, temperature, and weather conditions.

E. Notification: Notify Engineer in writing of any deviation from manufacturer's pre-shipment test data.

END OF SECTION 26 12 16

SECTION 26 19 13 COMBINATION MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Motor controller work as required, scheduled and specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

C. Siemens

D. Eaton

2.2 MOTOR CONTROLLERS

A. General: Combination motor controllers shall consist of an integrally mounted, thermal magnetic or magnetic only circuit breaker disconnect or fused disconnect switch as specified in Section 26 24 25. Magnetic, full voltage non-reversing (FVNR) or two speed controller as required, in a heavy duty type, dead front enclosure, surface-mounted; size and number of poles as required. Controllers shall be constructed and tested in accordance with NEMA Standards. Refer to Division 23 for Variable Frequency Inverter furnished by Division 23, installed by Division 26. Minimum controller size shall be NEMA Size 1.

B. Contacts: Magnetic controller contacts shall be silver alloy, and not require any filing, dressing, or cleaning for the life of the controller.

C. Operating Coils: Operating coils shall be 120V, pressure molded and designed so that accidental exposure to excessive voltage up to 480V will not damage the coil. Design controller so that when a coil fails due to over voltage, the controller shall open, and not freeze in the closed position.

D. Overload Relays: Controllers shall have manual-reset, trip-free, solid state, overload relays in each phase conductor. Three phase FVNR controllers shall have three overload relays. Single-phase FVNR controllers shall have an overload relay in each ungrounded conductor. Two speed, full-voltage magnetic controllers shall have overload relays for all six ungrounded conductors. Overload relays shall not be field-convertible from manual to automatic reset. Provide reset button located in front cover to reset all overload relays.

E. LED Pilot Lights: Provide 30.5mm run and stop pilot lights for all motor controllers. Furnish additional pilot lights for motor controllers as shown. Provide FAST and SLOW pilot lights for two-speed controllers. Pilot lights shall be mounted in the controller enclosure cover. Pilot lights shall be operated from an interlock on the motor controllers, and not be wired across the operating coil.

Green - Stop
Red - Run
Yellow - Slow
Blue - Fast

F. Controls: Controllers shall have 30.5mm HAND-OFF-AUTOMATIC switches. Provide for FAST-SLOW, REMOTE-LOCAL speed selection from HVAC control system for two-speed controllers. Two-speed controllers shall have deceleration relays between fast and slow speeds. Coordinate motor controller controls with the requirements of Division 23. Motor controller controls shall be mounted in the controller enclosure cover. Control switches shall be un-keyed rotary switches.

G. Control Power: A single phase control power transformer shall be included with each controller for 120V control power. The primary shall be connected to the line side of the motor controller through two fuses; the secondary shall have one leg fused and one leg grounded. Arrange transformer terminals so that wiring to terminals is not located above the transformer.

H. Auxiliary Contacts: Each controller shall have two normally open and two normally closed nonconvertible auxiliary contact in addition to the number of contacts required for the holding interlock and control wiring. One or more additional auxiliary contacts can be field installed without removing existing wiring, or removing the controller from its enclosure.

I. Phase Failure Monitors: Provide a 3-phase failure monitor for each motor controller. Monitor on any or all phases, for phase reversal from A-B-C sequence, under/over voltage, and phase failure. Provide adjustable relay for trip range. Provide automatic reset upon restoration of power to all phases. Where solid state overload relays provide this specified requirement, separate phase failure relays may be omitted.

J. Unit Wiring: Unit shall be completely pre-wired to terminals to eliminate any interior field wiring except for: connection of power supply conductors to switch line side terminals; motor leads to the controller load side terminals; and control conductors to holding coil terminals.

K. Enclosure:
1. Motor Controllers installed in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise.
2. Motor Controllers installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, and in other corrosive areas shall be NEMA 4X, Type 316 stainless steel.

L. Minimum interrupting rating shall be 35KAIC.

2.3 MANUAL MOTOR CONTROLLERS

A. General: Manual motor controllers shall consist of an integral controller and overload protection in a common enclosure, surface mounted. Size and number of poles shall be as shown and required with pilot light.

B. Manual Motor Controller: Manual motor controller with overload protection, 1 HP maximum, 115 or 230V.

C. Enclosures:
1. Manual motor controllers installed in indoor locations shall be NEMA 1 heavy duty enclosures unless shown otherwise.
2. Manual motor controllers installed at kitchen and food preparation locations, hose down areas, cooling towers, exterior locations, and in other corrosive areas shall be NEMA 4X, Type 316 stainless steel.

D. Disconnect Switch: For self-protected motors where one pole toggle motor control switch is allowed, the switch shall be horsepower rated and as specified for toggle switches in Section 26 27 73.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR CONTROLLERS

A. General: Install combination motor controllers where required or indicated and in accordance with the manufacturer's written instructions, requirements of the NEC and NECA Standard of Installation, and industry practices. Do not install motor controllers above ceilings. Do not install motor controllers on roofs.

B. Overloads: Install overload relays with manual reset in each phase of motor controller. Overload adjustable settings shall be based on actual motor nameplate full load amps. Field verify nameplate full load amps and adjust all relay settings accordingly.
1. Set overcurrent at motor service factor x motor nameplate FLA
2. Set high voltage trip to 8.3 percent above nominal voltage
3. Set undercurrent trip to four automatic restarts
4. Set all other trips to zero auto restarts
5. Phase Failure Relay: Adjust phase failure relay to 10 percent over voltage and 10 percent under voltage.

C. Coordination: Motor controllers shall be provided to coordinate with motors furnished by Division 23. Motor controller controls shall be provided to coordinate with controls specified in Division 23.

D. Supports: Provide individual and combination motor controllers with galvanized angle or other suitable supports if mounting on wall or other rigid surface is impractical. Controllers shall not be supported by conduit alone. Where motor controllers are mounted on equipment served, the switch shall not inhibit removal of any service panels or interfere with any required access areas. Manual motor controllers shall be installed plumb and aligned in the plane of the wall where they are installed.

E. Identify each motor controller as specified in Section 26 05 00.

F. Where motor controllers are indicated to be installed as part of a Motor Control Center, refer to the Motor Control Center specification.

3.2 TESTING

A. Provide the field services of the manufacturer to provide initial programming of all variable functions, start-up and commissioning of each motor controller.

B. Pre-Energization Check: Check motor controllers for continuous circuits and short circuits.

C. Post Hook-Up Test: After wire and cable hook-ups, energize motor controller to show it functions as specified.

D. Provide thermal infrared scan of the combination motor controllers rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION 26 19 13

SECTION 26 24 13 SWITCHBOARDS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included: Switchboard work as shown, scheduled, indicated, required, and specified.

1.2 QUALITY ASSURANCE

A. UL Labels: Provide switchboards UL labeled for service entrance and meeting requirements of UL 891.

B. NEMA Compliance: Comply with National Electrical Manufacturers Association (NEMA) Standard PB2, "Dead-Front Distribution Switchboards."

1.3 SUBMITTALS

A. Indicate:
1. Detailed dimensions for equipment foot print, front and side elevations.
2. Conduit entrance locations and requirements and restrictions.
3. Enclosure material, finish, and NEMA classification type.
4. Nameplate legends.
5. Size and number of bus bars
6. Switchboard instrument details.
7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB General Electric Co.

C. Siemens

D. Eaton

2.2 MATERIALS AND COMPONENTS

A. Except as otherwise indicated, provide the switchboard manufacturer's materials and components as indicated and as required for a complete installation.

2.3 DEAD-FRONT DISTRIBUTION SWITCHBOARDS

A. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The

appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.

B. Provide a factory-assembled, dead-front construction, metal enclosed, self supporting, switchboard of voltage, phase, ampacity, and short circuit interrupting rating and bracing shown.
   1. Switchboard shall consist of the required number of front and rear aligned vertical sections bolted together to form one metal enclosed rigid switchboard. The switchboard shall be designed as a free-standing with only front access. Rear and/or side access only where indicated to reduce switchboard depth and where NEC required rear access clearance is available.
   2. Switchboard shall include protective devices and equipment shown with interconnections, instrumentation, and control wiring. Small wiring, necessary fuse blocks, and terminal blocks in the switchboard shall be provided. Groups of control wires leaving the switchboard shall be furnished with terminal blocks with numbering strips.
   3. Factory installed permanent lock-off provision for pad-locking in the off position for all protective devices.

C. Enclosure Construction: The switchboard framework shall be fabricated for floor mounting. The framework shall be formed code gauge steel, welded and bolted together to support cover plates, busing, and component devices.
   1. Each section shall have an open bottom and individually removable top plates for installation and termination of conduit. Top and bottom conduit areas shall be shown and dimensioned on the shop drawings. Front plates used for mounting meters, selector switches, or other front-mounted devices shall be hinged, with wiring installed and laced, and with flexibility at the hinged side. Closure plates shall be screw removable and small enough for easy handling by one technician.
   2. Weatherproof enclosure front door(s) shall be pad-lockable and suitable for the intended environmental conditions. When indicated or specified, rear doors shall also be pad-lockable.

D. Busing: The switchboard busing shall be copper.
   1. The bus bars shall be braced to comply with the integrated equipment rating of the switchboard. The main horizontal bus bars between sections shall be located on the back of the switchboard to permit maximum available conduit entry area. The horizontal main bus bar supports, connections, and joints shall be bolted or welded, as required, so as not to require periodic maintenance. Bolted joint connections shall have at least two bolts per joint per phase. Half lapped bus joint construction is not acceptable.
   2. Buses shall be arranged A-B-C, left-to-right, top-to-bottom, and front-to-rear throughout. A ground bus shall be secured to each vertical section structure and extend the entire length of the switchboard.
   3. The main horizontal bus and incoming line shall be isolated and insulated from outgoing busing and cable connections.
   4. Each group mounted section shall have maximum full height bus. Where space is indicated, space shall be bused to install future switches or future circuit breakers sized as shown or a 600 Amp frame size circuit breaker or switch, whichever is greater.
   5. The main horizontal bus shall be non-tapered, fully rated, extended and drilled for future additions and splice plates.

E. Integrated Equipment Rating: Each switchboard, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short circuit rating shall certify that equipment can withstand the stresses of a fault equal to that shown in RMS symmetrical amperes. Ratings shall have been established by actual tests by the manufacturer on similar equipment construction as the subject switchboard. This test data shall be available and furnished, if requested, with or before the submittal of shop drawings.

F. Indicating Instruments: Switchboard instrumentation shall be digital display, panel mounted, rated for 120V, 60 hertz. The display unit shall be UL listed in accordance with UL 508. The electronic metering device shall have the following features:

1. Voltmeter, phase to phase and phase to ground or neutral.
2. Current, per phase RMS and 3 phase coverage.
3. Demand current per phase.
4. Power factor per phase and 3 phase average.
5. Real power, 3 phase total.
6. Reactive power, 3 phase total.
7. Apparent power, 3 phase total.
8. Frequency.
9. Average demand real power.
10. Adjustable demand interval (5 to 60 minutes).
11. Nonvolatile memory.
12. Password protected set-up and reset.
13. 3 current transformers with primary to match bus size and 5 ampere secondary with metering class accuracy.
14. Full scale readouts with the following accuracy:
    a. Current and voltage measurement +/-0.1%
    b. Power and energy +/-0.2%
    c. Frequency +/-0.5%
    d. Power Factor +/-1.0%
    e. Data update time 0.5 seconds (4 wire)
15. Metering Output.
    a. Pulse output based on kWh, kvarh, or kVAh.
    b. Analog output 4-20mA based on kWh, kvarh, or kVAh.
16. Monitoring:
    a. Harmonic analysis through 63rd with THD and TIF.
    b. Event recorder.
    c. Waveform capture.
    d. Data logger.
    e. Triggered trace memory.
17. Communication:
    a. Front port and dual rear mounted RS485 ports.
    b. BACnet protocol (coordinate with BMCS contractor).
    c. Mini RTU: digital 4 in/4 out.
    d. Analog 1 in/4 out.
    e. Local/remote display of all values.
18. Software:
    a. Windows based software shall be provided to enable setpoint programming.

G. The Main Protective Device(s) shall be individually mounted molded case circuit breaker(s):

1. Adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state true RMS sensing, without fusible elements, 100-percent continuous current rating.

2. Main protective devices with frame rated at 1000 Amps or greater shall have integral ground fault interrupter and provided with a portable test set or test switch.
3. Circuit breakers with 1,200 Amp frame and above shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
4. Provide shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.

H. Feeder and Branch Protective Devices greater than 1,200 Amps shall be individually mounted:
1. Molded case circuit breakers:
   a. Adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip. Solid state trip true RMS sensing, without fusible elements; 100-percent continuous current rating.
   b. Energy Reducing Maintenance System switch with local status indicator (ERMS).
   c. Shunt trip capability and wiring to terminal block for remote shunt trip switch wiring termination weather remote trip device is indicated or not.
2. Fusible switches:
   a. Each switch shall have an individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
   b. Fused switches 600 Amps and below, equipped for class J fuses.
   c. Fused switches 601 Amps and above shall be equipped with Class R or L rejection type fuse holders. Class RK1 or L of ampere rating and type as indicated on the plans suitable for application of the system.
   d. When required by the latest edition of the NEC or the AHJ, 1,200 Amp switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

I. Feeder and Branch Protective Devices 1,200 Amps and below shall be group mounted:
1. Molded case circuit breakers:
   a. Greater than 250 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
   b. 250 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
   c. 1,200 Amp frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
2. Fusible switches:
   a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
   b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
   c. 600 Amps and below equipped for Class J fuses.
   d. 601 Amps and above shall be equipped for Class R or L rejection type fuse holders.
   e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp

fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

J. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
   1. Ground fault protection shall be set at minimum setting for both current and time during construction. The switchboard manufacturer shall include in the submittal data for the switchboard, the minimum setting of the devices and the recommended setting for normal building operation.
   2. The ground fault system shall be factory-tested before shipment as specified:
      a. The switchboard manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
      b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
      c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

K. Mimic bus: Indicate busing, connections, and devices in single line form on the front panels of the switchboard using red colored plastic strips, fastened flat against the panel face with screws.

PART 3 - EXECUTION

3.1 INSTALLATION OF SWITCHBOARDS

A. Install switchboards where shown, in accordance with the manufacturer's written instructions, and industry practices to ensure that the switchboards meet the specifications. Provide weatherproof NEMA 3R enclosure housing outdoors, at wet locations, or where indicated on the drawings. Provide NEMA 3RX enclosure housing at corrosive locations of either aluminum or stainless-steel construction suitable for the intended environment when indicated on the drawings.

B. Comply with the requirements of NEMA and NEC, and NECA Standard of Installation, for installation of switchboards.

C. Where switchboard is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building’s grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the switchboard.

D. Torque bus connections and tighten mechanical fasteners.

E. Install fuses, of ratings shown, in each switchboard. Provide spare fuse cabinet with three

fuses of each size provided. Locate in central plant as directed by Owner.

F. Concrete Pads: Install switchboards on a 4" reinforced concrete housekeeping pad. The housekeeping pad shall extend 3" beyond the housing of the switchboard unless shown otherwise. Switchboard shall be bolted to the housekeeping pad using 3/8" minimum galvanized bolts and anchors on 30" maximum centers. Furnish the exact position of any block outs, dimensions, and location of the housekeeping pads to prevent delay of the concrete work.

G. Adjustment: Adjust operating mechanisms for free mechanical movement. Adjust circuit breaker time characteristic curves as recommended by the Fault Current and Coordination Analysis or as directed by the Engineer.

H. Indicating Instruments: Provide initial factory start-up and programming with Owner present. Integrate with the Building Management System for monitoring and logging of all system data.

3.2 TESTING

A. Notify Owner’s Commissioning Authority (CxA) prior to performing any tests so that the CxA may witness tests at the CxA’s discretion.

B. Pre-energization checks: Before energizing, check switchboards for continuous of circuits and for short circuits.

C. Switchboard insulation resistance test: Each switchboard bus shall be insulation resistance tested after installation is complete except for line and load side connections. Tests shall be made using Biddle Megger or equivalent test instrument at a voltage of not less than 1000 vDC. Resistance shall be measured from phase-to-phase and from phase-to-ground. Minimum acceptable value for insulation resistance is 2 megohms.

D. Ground Fault Interrupter (GFI) test: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50 percent of overcurrent device rating or 1,200 Amperes, whichever is lower.

E. Provide thermal infrared scan of switchboard under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to close-out.

F. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and time of test, relative humidity, temperature, and weather conditions.

3.3 TRAINING

A. Provide minimum 2 hours of dedicated training provided by a factory authorized representative to Owner’s personnel regarding programming, operating, and use of switchboard components including all indicating instruments and safety features.

END OF SECTION 26 24 13

SECTION 26 24 16 PANELBOARDS AND ENCLOSURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Panelboards and enclosures, including cabinet, as shown, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

A. UL Standards: Panelboards and enclosures shall confirm to all applicable UL standards and shall be UL labeled.

1.3 SUBMITTALS

A. Indicate:
1. Detailed dimensions.
2. Enclosure material, finish, and NEMA classification type.
3. Location of main circuit breaker.
4. Mounting and trim.
5. Acceptable incoming conductors' size.
6. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, bus material and rating, withstand ratings, lugs, and time current curves of all overcurrent devices and components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

C. Siemens

D. Eaton

2.2 MATERIALS AND COMPONENTS

A. General: Panelboards shall be dead-front type equipped with fusible switches or circuit breakers as shown and as required.

B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.

C. Busing Assembly: Panelboard phase, neutral, and equipment ground busing shall be copper. Bus structure and mains shall have ratings as shown and scheduled. Furnish a bare uninsulated ground bus inside each panelboard enclosure. Two section panelboards shall be connected with copper cable, with an ampacity conforming to the upstream overcurrent device. Neutral bus termination quantity for branch circuit panelboards shall match or exceed the maximum number of single pole circuit breakers the panelboard will accept.

D. Main circuit breakers and feeder / branch circuit breakers:
1. Less than 125 Amps: Thermal magnetic with factory fixed trip.
2. 125-600 Amps: Thermal magnetic with adjustable instantaneous trip of 5X – 10X with short time tracking.
3. 601 Amps and larger: Solid state true RMS sensing with adjustable: current set by rating plug or adjustable dial, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
4. Provide permanent lock-off device for all fire alarm system branch circuit breakers, for all smoke control fans and equipment, and where indicated or required for circuit breaker to be used as a remote safety disconnect switch.
5. General requirements:
    a. Make prepared space provisions for additional breakers or fused switches so that no additional bus or connectors will be required to add circuit breakers or fused switches in the available device mounting space.
    b. Two and three pole breakers shall have internal common trips.
    c. All circuit breakers used as the main or branch mounted back-fed main shall be bolt-on. All circuit breakers used in 600 Amp and smaller panelboards shall be bolt-on breakers. Circuit breakers for distribution panelboards rated 601 amps and larger shall have plug-on or bolt-on circuit breakers.
    d. Branch circuit panelboard shall have interrupting capacity as shown or as required, but in no case less 10k AIC for 120/208/240-Volt systems, and 18k AIC for 277/480-Volt systems.
    e. 15 and 20 Amp circuit breakers for lighting circuits shall be UL listed switch duty (SWD).
    f. Personnel ground fault interrupter (GFI) circuit breakers, where shown, shall be maximum 5 mA ground fault trip and shall include a TEST button.
    g. Equipment ground fault interrupter (EGFI/EGPD) circuit breakers, where shown or required shall be 30mA ground fault trip and shall include TEST button.
    h. Circuit breakers with 1,200 Amp and larger frame shall have Energy Reducing Maintenance Switching with local status indicator (ERMS).

E. Fusible Switches for distribution panelboards: Fusible switches shall be quick-make, quick-break type. Each switch shall be enclosed in a separate steel enclosure. The enclosure shall employ a hinged cover for access to the fuses. Interlock cover with the operating handle to prevent opening the cover when the switch is in the ON position. This interlock shall be constructed so that it can be overridden for testing fuses without interrupting service. The switches shall have padlocking provisions in the OFF position. Switches shall include positive pressure rejection type fuse clips for use with UL Class J fuses and be UL labeled for 200,000 AIC.

F. Spaces: Where space for future breakers or switches is shown, panelboard enclosure shall include removable blank panels or knockouts to allow installation of future breakers or switches, prepared spaces, and panelboard busing shall be complete, including

required connectors.

G. Integrated Equipment Rating: Do not apply series ratings. Each panelboard, as a complete unit, shall have a short-circuit rating equal or greater than the available short circuit current. Rating shall have been established by tests on similar panelboards with the circuit breakers or fusible switches installed.

H. GFCI circuit breakers not available in the required panel AIC rating shall be series rated with the upstream over current protection device to provide the panelboard with required AIC rating. Coordinate series rating requirements with manufacturer. Mark the panel per NEC 110. The marking shall be visible and state the following: "CAUTION-ENGINEERED SERIES COMBINATION SYSTEM RATED XXX AMPERS. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED".

I. Panelboard Enclosures:
1. Provide sheet steel enclosures, minimum 16-gauge nominal thickness, with multiple knockouts, unless shown otherwise. Provide all NEMA 1 panelboard fronts with spring-loaded door pulls, and flush lock and key, panelboard enclosures keyed alike to match the Owner's standard key system; coordinate with Owner.
2. All NEMA 1 enclosure panelboards shall be hinged "door-in-door" type with interior hinged door with hand operated latch or latches, as required providing access only to circuit breaker or fusible switch operating handles, not to exposed energized parts. Outer hinged door shall be securely mounted to the panelboard box with factory bolts, screws, clips, or other fasteners, requiring a tool for entry. Hand operated latches are not acceptable. Push inner and outer doors shall open left to right. Manufacturer hardware (OEM), screws, and bolts shall be used to secure dead fronts and covers. Do not used third party hardware. Do not use power tools to secure panel hardware. Provide gray powder coat finish over a rust inhibitor.
3. Equip with interior circuit directory frame, card, and clear plastic covering for panelboards.
4. Panelboards located in kitchen preparation or natatorium areas shall have Type 316 stainless steel front, door, and trim with a NEMA 1 rating for the entire enclosure.
5. Panelboards at exterior locations shall be NEMA 4X Type 316 stainless steel.
6. Panelboards at hose down areas, cooling towers, in greenhouses, and other corrosive locations shall be NEMA 4X 316 stainless steel.
7. Enclosure shall be for recessed or surface mounting as shown or as required.
8. Enclosures shall be fabricated by the same manufacturer as panelboards to be enclosed. Multi-section panelboards shall have same physical dimensions.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS AND ENCLOSURES

A. General: Install panelboards and enclosures, as shown, including electrical connections, in accordance with the manufacturer's written instructions, the requirements of NEC, NECA Standard of Installation, and industry practices. Circuit breakers shall be factory installed except for required field modifications due to actual site conditions.

B. Coordination: Coordinate installation of panelboards and enclosures with conductor and raceways installation work.

C. Anchoring: Anchor enclosures to walls and structural surfaces ensuring that they are

permanently and mechanically secured.

D. Directory Card: Provide a typed circuit directory card(s) upon completion of work. Directory card shall be of super heavy-weight index card stock, 110 lb, white. Directory shall include type of load (i.e.: receptacles, lighting, exhaust fan, etc.) and location (i.e.: Room 102, Office, etc.) Room number shall be identified as the actual graphics room number assigned to the space and not the room number identified on the Plans. Circuits with shunt trip shall be identified with the control circuit operating the shunt trip (i.e.: Kitchen Hood No. 2). Shunt trip breakers with common trip circuit shall be grouped in the panelboard (i.e.: circuits 1, 3, 5 and 7).

E. Fuses: Install fuses, of the ratings and class shown.

F. Circuit Arrangement: Branch circuits shall be arranged to provide the best possible phase balance, unless shown otherwise.

G. Panelboards not intended to be used as service entrance (SE) rated or for establishing a separately derived neutral system shall have the factory installed neutral to ground bonding screws and straps removed and disposed of.

H. Recessed or flush mounted panelboards: Terminate spare conduits in junction box 18-inches above accessible ceiling close to panelboard location. Label junction box cover as “not used” and include panel identification.
1. Provide (3) 1-inch and (3) ¾-inch spare conduits above accessible ceiling to j-box from each panelboard section.
2. Where recessed panelboard is located above another building floor, also provide (3) 1-inch and (3) ¾-inch conduits to j-box in ceiling space on floor below.

I. Conductors shall be bent neatly opposite the fuse switch or circuit breaker to which they are to be attached. Vertically installed conductors shall be neatly tie-wrapped. Conductors shall be connected in a neat and professional manner. Conductors brought in from the top or bottom of the cabinet shall be bent neatly opposite the fuse or circuit breaker to which they are to be attached. Each conductor shall be run along the full height of the panel and returned to the circuit breaker or fuse location to allow relocation of the conductor to any position along the bus. Panelboard shall be cleaned of all construction debris prior to substantial completion review. Neutral and grounding conductors shall be installed similar to the phase conductors.

J. Circuit breakers and conductors installed for SPD devices shall be located on the same side as the SPD to allow the shortest and straightest run of conductors in respect to the location of the SPD device. Route all conductors to the SPD device with straight as possible run, using longest sweep bends and the shortest conductor length possible. Twist all SPD conductors and secure with tie straps wherever possible.

K. Install copper ground bus for copper ground conductors. Ground conductors size #1 and larger are to be landed to panelboard enclosure with mechanical lugs and not to ground bus.

L. Install panels so that breaker number 1 is the top left breaker.

M. In panels that contain multi-layered neutral bus, install neutrals beginning with the back neutral bus row and work forward. Do not make up neutrals on front neutral bus row unless all other rows are full.

N. Label breaker mounting space with stick-on number labels.

O. Mount the fully aligned panelboard such that the maximum height of the top circuit breaker above the finished floor shall not exceed 78-inches. Mount panelboards as high as practical and such that the bottom of the cabinets will not be less than 6 inches above the finished floor.

3.2 TESTING

A. Before energizing, energization, check for continuity of circuits and short circuits.

B. Provide thermal infrared scan of panelboards under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to close-out.

END OF SECTION 26 24 16

SECTION 26 24 25 ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.

B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Schneider Electric - Square D

B. ABB-General Electric Co.

C. Siemens

D. Eaton

2.2 ENCLOSED SWITCHES

A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horsepower served.

B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.

C. Switch Mechanism:
1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.

D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.

E. Auxiliary Contacts: Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch.

2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

A. Overcurrent protective devices 1,200 Amps and below:
   1. Where switch is intended as a building service disconnect provide solid neutral and ground bus and service entrance SE rating.
   2. Molded case circuit breakers:
      a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I^2t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
      b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
      c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
   3. Fusible switches:
      a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
      b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
      c. 600 Amps and below equipped for Class J fuses.
      d. 601 Amps and above shall be equipped for Class R or L fuses.
      e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).

B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
   1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building operation.
   2. The ground fault system shall be factory-tested before shipment as specified:
      a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-

characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.

b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.

c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

2.4 ENCLOSURES

A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.

B. Enclosures in exterior locations shall be NEMA 4X stainless steel.

C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.

B. Location: Provide safety switches within 50’ and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).

C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.

D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.

E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.

F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety

disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: “WARNING” (1/2 Inch Letters). “TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE.” (1/4 inch letters).

G. Provide disconnect switch for electric duct heaters.

H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building’s grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.

I. Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch, coordinate with Division 28. Coordinate with fire detection and alarm contractor for the fire alarm and detection system to monitor all disconnect switches open/closed position that serve the smoke control system. All fire alarm and control wiring directly related to the monitoring of the supply power disconnect switches and control of the smoke control fans shall be installed in conduit.

3.2 TESTING

A. General: Before energizing, check for continuity of circuits and short circuits.

B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION 26 24 25

SECTION 26 24 30 FUSES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Fuse work as shown and scheduled, and as specified.

B. Types: Fuses required for the project include the following:
1. 250 volt current limiting fuses
2. 600 volt current limiting fuses

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by Bussman or Littlefuse.

2.2 CURRENT LIMITING FUSES - 600 VOLTS AND LESS

A. General: Provide 200,000 amperes interrupting capacity (AIC) current-limiting fuses of the current ratings shown and voltage rating equal to or greater than the voltage at the point of application.

B. Types:
1. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 600 amperes or less, shall be UL Class RK1 or Class J, time delay fuses, Bussman LPS-RK (600V) LPJ-SP (600V), LPN-RK (250V).
2. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 601 to 4000 amperes, shall be UL Class L time delay fuses, Bussman KRPC "HI-CAP".
3. Fuses in circuits supplying other than motor loads, 600 amperes or less, shall be UL Class RK1, time delay fuses, Bussman LPS-RK (600V), LPN-RK (250V).
4. Fuses supplying surge protection devices (SPD) shall be surge rated for use with SPD devices.

2.3 SPARE FUSES

A. General: Provide spare fuses in the amount of 10% of each type and size installed, but not less than 3 spares of a specific size and type. Deliver to the Owner at the time of project acceptance. Fuses shall be encased in a labeled steel enclosure with padlock provision, to be wall mounted where directed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install fuses in fuse holders immediately before energizing of the circuit where the fuses are installed. Fuses shall not be installed and shipped with equipment.

B. Labels: Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

END OF SECTION 26 24 30

SECTION 26 27 73 LINE VOLTAGE WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.2 QUALITY ASSURANCE

A. UL Label: Wiring devices shall be UL labeled.

B. NEMA Standard WD1 and WD6.

C. Fed. Spec. WC596, W-S-896

1.3 SUBMITTALS

A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy of the specification section with the product data.

B. Submit a sample of each style and color of 120-Volt duplex receptacle and each 120/277-Volt switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.

C. Submit manufacturer's product data sheet for each style of device and plate on the project.

D. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toggle switches, straight blade and twist lock devices, interior cover plates:
1. Leviton
2. Hubbell
3. Eaton
4. Wattstopper (digital time switches)

B. Dimming

1. Leviton
2. Lutron

2.2 WIRING DEVICE COLOR

A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source shall be red, and heavy duty 30 Amp and larger simplex devices which shall be black in color where the building standard color is not available. Provide equivalent hospital grade devices where red is not available in grade specified. Verify with Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches. Low voltage lighting control devices specified elsewhere shall match the line voltage wiring device color specified in this section.

2.3 RECEPTACLES

A. Industrial grade tamper resistant smooth face duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, locking plug-tail or back and side wired with screw type terminals, NEMA indicated, (X=color designation).
1. 20A, 125V duplex NEMA #5-20R: Leviton #5362-SGX
2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #5362-IGX
3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R weather and tamper resistant: Leviton #G5362-WTX
4. 20A, 125V weather resistant (WR), tamper resistant: Leviton #TWR20-GY
5. 20A, 125V plug load control, split circuit marked for “controlled”, tamper resistant: Leviton #TDR20-S1G
6. 15A, with 20A feed-through, NEMA #5-15R, 125V duplex, arc fault (AFCI), tamper resistant: Leviton #AFTR1-HGX

B. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back or side wiring, black molded phenolic compound.
1. 15-60A, 125-250V, straight blade, NEMA configuration as indicated or as required by Owner.
2. 15-50A, 125-480V, twist lock, NEMA configuration as indicated or as required by Owner.

C. Hospital grade receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mount straps, locking plug-tail or back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated.
1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (orange)
3. 20A, 125V ground fault circuit interruption (GFCI) with indicator light: Leviton NEMA 5-20R-8898-HGX
4. 20A/125V Tamper Resistant Duplex NEMA 5-20R: Leviton 8300-SGX

D. USB 2-port charger / tamper-resistant with 125-Volt receptacles:
1. USB type A/C, 1 type A and 1 type C port, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5833-HGX
2. USB A, 2 type A ports, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5832-HGX

E. USB 4-port charger:

1. USB type A+C, 2 type A ports and 2 type C ports. 5.0A 5.0VDC charging. Hubbell #USB4ACX.
2. USB type A, 4 type A ports. 5.0A 5.0VDC charging. Hubbell #USB4X.

2.4 WALL SWITCHES

A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
2. Double pole 120/277V, 20A switch: Leviton #1222-2X
3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
4. Four-way, 120/277V, 20A switch: Leviton #1224-2G
5. Pilot light single-pole, 120/277V, 20A switch: Leviton #1221-PL
6. Momentary, 120/277V, 20A, single-pole double throw, center off: Hubbell only, #HBL 1557G

B. Rotary key operated switch (verify manufacturer and keying with Owner prior to construction).
1. Single-pole, 120/277V, 20A key operated switch: Leviton #1221-KL
2. Two-pole, 120/277, 20A key operated, Leviton #1222-2KL.
3. Three-way, 120/277V, 20A key operated switch: Leviton #1223-3KL
4. Four-way, 120/277V, 20A key operated switch: Leviton #1224-4KL
5. Key switches shall all be keyed alike to match the Owner's standard key system. Leviton #WS-35 or as otherwise directed by Owner.

2.5 WALL DIMMERS

A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
1. Single-pole, 120/277V, 1000/2308 Watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
2. Single-pole, 120/277V, 1500/3463 Watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
3. Single-pole, 120/277V, 1920/4432-Watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
4. Three, four- or five-way remote switch: Leviton #AWSRT-00W.
5. Color change kit as required.

2.6 GFCI – GROUND FAULT CIRCUIT INTERRUPTER, BLANK FACE

A. 20A, 125V, GFCI, switch rated, blank face feed through, Hubbell #GFBF20GYL, gray finish, stainless steel cover plate black laser engraved with device protected, (example: DRINKING FOUNTAIN GFCI).

2.7 INTERIOR WALL COVER PLATES AND FASTENERS

A. Type 302 non-magnetic stainless-steel with satin finish (also required for wall box device cover plates for low voltage and digital lighting controls specified elsewhere).

B. Cover plate laser plate engraving for device identification (other than low voltage lighting controls).
1. Provide laser cover plate engraving with black filling for all wiring devices

indicating panelboard name, circuit, and voltage.

2. Wiring devices connected to emergency/stand-by generator or inverter shall include the word “EMERGENCY”.
3. Text orientation shall be upright, readable from left to right when cover plate is installed.
4. Remotely located lighting switches shall also indicate the room or area and zone controlled by each switch. Coordinate specific wording with Owner/Architect.
5. Blank face GFCI cover plates shall also intuitively indicate the load or equipment served, device, or area protected downstream (“EDF” for drinking fountains, “RM RECEPTS”, “HOOD RECEPTS”, “VENDING”, “REFRIG”, etc.) For other loads, Owner/Architect shall determine name plate wording.

2.8 EXTERIOR COVER PLATES

A. Thomas & Betts CK Series, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.
1. Vertical mount receptacle: #CKSUV
2. Horizontal mount receptacle: #CKMU
3. Two-gang: #2CKU
4. 30-60 Amp Devices: #CKLSUV

2.9 CORD REELS AND DROP CORDS

A. Cord Reels:
1. Lighted cord reels: Industrial grade, LED hand Lamp only, 125V, 45-foot 16/3 SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.
2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.
5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.

B. Drop cord receptacles:
1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.

2.10 FIRST RESPONDER EMERGENCY REMOTE POWER OFF (FREPO) STATION

A. Knox Company Remote Power Rapid Access 4500 Series Shutdown Station
1. Recessed mount for public spaces and new construction, surface mount for when mounted to equipment or existing construction.

2. Single lock keyed for local Fire Department/AHJ, verify configuration and keying with Knox Company.
3. Red Finish
4. Tamper alert for integration with building security system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cover plates for receptacles and toggle switches shall be of the same manufacturer throughout unless otherwise noted.
   1. Key switches and keys shall be as specified and also as approved by Owner.
   2. Submit samples for each specified toggle switch and duplex receptacle color to Architect.

B. Install wiring devices where shown and as required, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.

C. Install receptacles and switches only in electrical boxes that are clean, free from building materials, debris, and similar matter.

D. Install wiring devices plumb and aligned in the plane of the wall, floor, ceiling or equipment rack.

E. Install switches in boxes on the strike side of doors as hung. Install so the up position will close the circuit or will be the highest level of illumination. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.

F. Provide a cover plate for every wiring device and blank cover plates for unused rough-in-only boxes that matches the building standard. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.

G. Mounting heights of all wiring devices shall comply with local accessibility standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.

H. Refer to Architectural drawing and elevations, etc. for exact location of wiring devices. Coordinate location of all wiring devices with other trades, specialty items, and millwork and resolve all conflicts prior to rough-in. Field coordinate exact mounting location with all trades to avoid and resolve conflicts during construction.

I. Locate receptacles for electric drinking fountains/coolers and bottle fill stations below equipment so that the receptacle is accessible and concealed as much as practical from public view by the equipment open cowling so that the receptacle remain readily accessible. For dual level basin equipment, locate receptacle under the upper basin.

J. Provide convenience outlet receptacle within 25-feet of all new electrically operated mechanical equipment.

K. Where exterior receptacles are intended for continuous use, mount in horizontal position with while in use cover plate. (Exterior electric drinking fountains, ice makers, ice storage bins, landscape lighting low voltage transformers, seasonal decorative lighting, etc.)

L. Install wall box dimmers to achieve full rating specified after de-rating for ganging as recommended by manufacturer.

M. Do not share neutral conductor on load side of dimming switches.

N. Install receptacles with grounding pole down, except in any of the following conditions where the grounding pole shall be installed in the up position: healthcare occupancies, if required by local AHJ, if required by Owner's construction standards or if directed by Owner or Architect. If installed horizontally, install with neutral pole on top.

O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

P. Provide pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by manufacturer.

Q. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.

R. Provide toggle switch within sight of all trap primers, circulation pumps, 120-Volt motors and motorized equipment to serve as the equipment disconnect switch.

S. Mount cord reels and cord reel recessed enclosures to structure with galvanized steel struts and as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.

T. Mount drop cord suspension hook or j-box to structure to support the cord's weight and additional normal use pulling tension and as recommended by manufacturer. Use cable grips, either with cord grip hanging hook at open ceilings or with chrome plated escutcheon cover plate mounted to recessed j-box at finished ceilings. Field verify exact location, drop height, and NEMA outlet configuration of drop cords with Owner/Architect. Provide weatherproof receptacle cap or covers if located in wet location. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc.

3.2 GROUND FAULT PROTECTION FOR PERSONELL

A. When GFCI personnel protection receptacles are not commercially available or cannot be installed at a readily accessible location or indicated otherwise on the drawings, GFCI personnel protection shall be provided by a remote blank face GFCI wiring device or by an up-stream GFCI receptacle that also provides downstream GFCI protection and located in a readily accessible location. When branch circuit breaker device with integral GFCI protection is required or specified, it shall be within the manufacture's recommended distance limitations of the connected receptacle(s) or load(s) for proper GFCI personnel protection at the farthest outlet.

B. GFCI personal protection locations include but are not limited to the following:
   1. For other than dwelling units: All single phase 125-250-Volt (150-Volts to ground or less) receptacles 50-Amperes or less, and all three phase 125-250-Volt (150-Volts to ground or less) receptacles 100-Ampres or less in the locations indicated below.

2. Dwelling units: All single phase 125-250-Volt receptacles installed in the following locations indicated below.
3. Provide personnel GFCI protection as indicated above in the following locations and all additional locations as required by the NEC.
    a. Outdoors (with exceptions for not readily accessible receptacles with dedicated branch circuits for snow melting, deicing, pipeline/vessel heat receptacles. Provide these loads with 30mA EGFI circuit breaker protection).
    b. Bathrooms/toilets/restrooms
    c. Janitors/custodial closets and mop sinks.
    d. Laundry areas
    e. Within 6-feet of all water sources including sinks, mop-sinks, lavatories, bathtubs, shower stalls, faucets, eye wash stations, emergency shower stations
    f. Indoor damp and wet locations
    g. Locker rooms
    h. Vending machines
    i. Electric vehicle charging equipment.
    j. All receptacles serving kitchen or food preparation counter tops.
    k. Drinking water fountains/coolers and bottle fill stations
    l. Dish washers
    m. Receptacles at end of cord reels or drop cords.
    n. Central plant, mechanical rooms and electrical rooms.
    o. Receptacles that serve educational science and science prep room counter tops.

C. Where a GFCI protected receptacle outlet is required or indicated behind vending machine, refrigerators or other equipment, provide remote GFCI blank face in same room as protected receptacle and at a readily accessible location with standard receptacle outlet behind equipment. Refrigerators shall be GFCI protected only where located within 6-feet of power cord distance from the edge of a sink to the surface of the refrigerator.

D. Unless indicated otherwise, locate blank face GFCI device near light switches at same height as light switches or ganged with the light switch. Provide GFCI protection for all receptacle outlets located below 42-inches in all infant through 2-year old day care and similar areas designated for occupancy by infant through 2-year old day care occupants so the GFCI device can easily be intentionally tripped or tested and reset.

E. Provide branch circuit breaker 30mA (EDP) or 100mA (EPE) equipment protection for utilization equipment as required by the NEC and where indicated on the drawings.

3.3 FIRST RESPONDER REMOTE EMERGENCY POWER OFF (FREPO) STATION

A. Provide Knox Company first responder remote emergency power off (FREPO) stations as indicated and/or where required by local AHJ. Mounting locations shall be as directed by the local AHJ and exact locations coordinated with the Architect. FREPOs shall be circuited only to shunt trip or shut-down control circuiting. FREPOs shall be recessed mounted in public locations and in all new construction when attached to building construction. Provide surface mount FREPOs when mounted to equipment or existing construction.

B. Integrate the FREPOs to shut-down the building non-emergency and non-legally required power sources which include the main electrical utility service disconnect circuit breaker(s), other than non-life safety or non-legally required distribution scale UPS equipment, and non-life safety or non-legally required local power generation equipment.

C. Provide FREPOs for fire pump, life safety, and legally required electrical generation equipment only when required by the AHJ. When required by the AHJ, fire pump, life safety, and legally required power generation and/or stored energy power supply equipment shall each have separate dedicated FREPOs that shut down only their associated power generation/stored energy equipment. FREPOs for emergency, and legally required systems shall have minimal 25-foot physical separation from the building main utility service FREPOs and clearly labeled with the equipment that they will shut down. FREPOs for fire pumps shall have minimal 25-foot physical separation from the any other FREPOs and from the building main utility service disconnect and clearly labeled with the equipment that it will shut down.

D. Integrate the FREPOs tamper switch with the building security or building management control system (BMCS) as directed by Owner.

3.4 TESTING

A. Before energizing, check for continuity of circuits, short circuits, and grounding connections.

B. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization, voltage and phase orientation if intended 3-phase equipment is phase orientation dependent for proper motor rotation or operation.

C. Test each individual GFCI receptacle and all downstream receptacles protected by an upstream GFCI device with simulated ground fault tester, make corrections as necessary.

D. Operate each wall switch with circuit energized and verify proper operation.

END OF SECTION 26 27 73

SECTION 26 32 13 NATURAL GAS STANDBY GENERATOR SETS and TRANSFER SWITCH

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.2 WORK INCLUDED

A. Furnish and install standby engine-driven generator system, complete with wiring and controls as shown on the drawings and as specified herein.

B. The standby emergency system shall consist of an engine-driven generator set designed and sized for project site ambient conditions and project site altitude, complete for outdoor installation where specified or required outdoors, automatic transfer switches and associated fuel system.

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers:
   1. Engine-Driven Generator Sets:
      a. Cummins
      b. Caterpillar
      c. Kohler
   2. Automatic Transfer Switch.
      a. Cummins
      b. Caterpillar/ASCO
      c. Kohler
      d. Standby electric generating system manufacturer (as an integral part of a complete system).

B. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems (NFPA 99 & 110), and with NFPA 37 Installation and Use of Stationary Combustion Engines and Gas Turbines.

C. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to generator construction.

D. EPA Compliance: Comply with all EPA Standards for permanently installed natural gas emergency generators.

E. Testing: The generator set shall receive the manufacturer's standard factory load testing.

F. Supplier: All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade Power System products for a minimum of 15 years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier is to be authorized to perform warranty service on all products provided. Within 50 miles of the job site, the supplier shall maintain; a minimum of 6 factory-trained and qualified field technicians; a proper supply of spare parts for the supplied equipment; a shop with

overhaul capabilities; and be able to provide 24 hour, 7 day per week, 365 day per year field service capability.

1.4 SUBMITTALS

A. Submit manufacturer's certified computer-generated performance and capacity data in accordance with specification requirements. Indicate and include all ambient and altitude de-ratings and calculations.

B. Submittal drawings and information on the transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished.

C. Submit manufacturers' "Installation, Start-Up and Service" instructions, recommended conductors, overcurrent protection, and electrical interlocks.

D. Submit recommended clearance dimensions.

E. Submit sequence of operation in narrative form.

F. . Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams.

1.5 WARRANTY

A. Provide five-year parts and labor warranty from date of substantial completion for generator set(s) and transfer switch(es).

PART 2 - PRODUCTS

2.1 ENGINE-GENERATOR SETS

A. The engine-generator set shall be furnished as a complete working system. The model provided shall be a standard model that is quality assurance tested and prototype tested, not one of a kind without supporting literature.

B. Engine shall be liquid cooled, reciprocating engine, 12V DC electric start, natural gas fueled, electronic isochronous governed with manual speed adjustment plus/minus 5%, with belt-driven battery charging alternator.

C. The set shall provide the following performance:
1. Rated power for the duration of any utility power outage, in ambient conditions to 500-feet altitude and an outside air ambient temperature of 0 (zero) degrees F to 110 degrees F. Liquid coolant system ratings for natural gas sets through 140KW shall be rated at 122 degrees F ambient.
2. Start and accept rated load within 10 seconds of utility power outage.
3. Voltage regulation of plus/minus 2% no load to full load with random voltage variation, at any constant load, less than plus/minus 1%.
4. Isochronous frequency regulation, less than plus/minus 0.5% at any steady state load from no load to full load.

D. Engine Coupling: Engine shall be directly connected to the generator through a suitable flexible coupling.

E. Generator:

1. The generator shall be a standard make, 4-pole, revolving field, single bearing, synchronous, brushless type with the following characteristics:
   a. Capacity as shown on the drawings and shall operate at 1800 rpm.
   b. Dripproof, self-ventilating, permanently aligned and complete with rotating brushless exciter and shall be of ball bearing construction and connected to the engine with flexible disc coupling.
   c. Conform to the latest applicable IEEE and NEMA standards.
   d. Provided with generator overload protection or generator manufacturer's overload protective circuitry.
   e. Output main circuit breaker(s) with adjustable LIS trip for cable protection shall be provided when shown on drawings. Circuit breaker manufacturer shall be the same as switchgear manufacturers specified and submitted to be used on this project.
   f. Voltage Regulator: Include a full wave rectified automatic digital voltage regulation system matched and prototype tested by the engine manufacturer with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below an adjustable frequency threshold. Torque matching characteristic shall be adjustable for roll-off frequency and rate, and be capable of being curve-matched to the engine torque curve with adjustments in the field.
   g. Alternator: The generator shall be capable of withstanding a three phase load of 300% rated current for 10 seconds, and sustaining 150% of continuous load current for 2 minutes with field set for normal rated load excitation.
2. Provide the generator with the following:
   a. Minimum 130°C rise stand-by rating
   b. NEMA Class F or H insulation as defined by NEMA MG1.65
   c. Temperature rise by resistance and embedded detector measurements at rated load within NEMA MG1-22.40 definition.
   d. Pre-lubricated, maintenance free ball bearing, lubricated for life.
   e. Direct drive centrifugal blower cooling.
   f. RFI filters on the exciter to eliminate radio frequency interference on electronic equipment.
   g. Thermostatically controlled block strip heater mounted for condensation control.

F. Sub-Base: The engine power plant shall be mounted on an I beam, box type sub-base of fabricated steel construction. The assembly shall be installed on a vibration-absorbing base on a concrete pad as shown on the drawings.

G. Automatic Starting Sequence of Events:
1. Upon drop in normal source voltage to 65 to 70% of rated voltage, or upon failure of the normal source of electrical supply, the engine shall be automatically cranked and brought up to the full operating speed.
2. The cranking motor circuit shall be instantly broken when the engine starts.
3. Within 10 seconds the generator shall be brought up to operating speed; the generator voltage shall operate the automatic transfer switch, disconnecting the load from the normal source of supply and connecting the emergency power to the load.

4. Upon restoration of the normal source voltage to 92 to 95% of rated voltage or restoration of normal source of supply, the sequence shall be reversed, restoring the transfer switch to the automatic normal operating position, disconnecting the load from the emergency generator and reconnecting the load to the normal source of supply. The emergency generator set will continue to operate for a period of from 1 to 5 minutes after the restoration of the normal source of supply. Should the engine fail to start upon the first crank, there shall be two additional cranking attempts made with a 15 second rest between cranks, after which the cranking cycle shall cease and an alarm shall sound to indicate malfunctioning of the system.
5. The controls shall automatically stop the engine in the event the cooling water temperature becomes too high, if the coolant level becomes too low, if the oil pressure drops below a pre-determined pressure, or if the engine overspeeds. Upon the failure of the engine for any of the above reasons, an indicating lamp will operate indicating the condition under which the engine was shut down. Also, the alarm signal shall be energized.

H. Engine Control Panel & Accessories:
1. Provide a comprehensive monitoring and control system integral to the Generator Set control to guard the electrical integrity of the alternator and power system. Provide single and 3-phase fault current regulation, so that downstream protective devices have the maximum current available to quickly clear fault conditions, without subjecting the alternator to potentially catastrophic failure conditions. Include provisions to either prevent over voltage due to single phase faults, or to shut down the generator set if line to neutral voltage on any phase exceeds 115% for more than 0.5 seconds. Acceptable methods are a fully rated (100%) 600 volt Circuit Breaker, mounted in the generator enclosure, Schneider Electric - Square D Programmable Micrologic of size as indicated on drawings with handheld programmer or inherent protection provided by microprocessor-based GenSet AmpSentry protection. Submittals shall demonstrate that the protective device provides proper protection for the alternator by a comparison of the trip characteristic of the breaker with the thermal damage characteristic of the alternator. Field circuit breakers shall not be acceptable for generator overcurrent protection. The control system shall actively control the fuel rate and excitation as appropriate to the state of the generator set. Fuel rate shall be regulated as a function of starting, accelerating to start disconnect speed, accelerating to rated speed. The governing system shall include a programmable warm up at idle and cool-down at idle function. While operating in idle state, the control system shall disable the alternator excitation system. An electronic governor system shall provide automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The Control Panel shall include, but is not be limited to, the following instruments and protective devices:
    a. AC Ammeter.
    b. Phase Selector Switch.
    c. Current Transformers.
    d. AC Voltmeter.
    e. Automatic Solid State Voltage Regulator with immunity to severe induced waveshape distortion from nonlinear leads.
    f. Rheostat for Adjusting voltage ± 5% of Rated Voltage.
    g. Engine Malfunction Warning Lights/Audible Alarm:
        1) Anticipating High Engine Temperature.
        2) Anticipatory Low Oil Pressure.
        3) Low Fuel.

4) Control Switch not in Automatic Position.
5) Low Water Temperature.
6) Low Oil Pressure.
7) High Water Temperature.
8) Engine Overcrank.
9) Engine Overspeed.

h. Frequency Meter.
i. Non-resettable Elapsed Time Meter with a 9,999.9 Hour Maximum Indication.
j. Coolant Temperature Gauge.
k. Oil Pressure Gauge.
l. Provisions for Remote Emergency Shutdown.
m. Combination alarm shutdown system with manual reset and indicating lights for high engine temperature, low oil pressure, engine overspeed, and engine failed to start. Include an additional set of contacts for remote alarms.
n. Manual run/off/automatic selector switch for control of engine with flashing red light, and shall allow manual starting of plant without assuming load.

2. Provide low coolant level shutdown, which shall activate high engine temperature lamp and shutdown.
3. Solid-state cranking cycle device preset at 15 second cranking cycle and 15 second rest cycle followed by a 15 second cranking cycle. If engine fails to start after 3 crank cycles and 2 rest cycles, an overcranking alarm shall sound and cranking cycle shall stop. Provide adjustments in accordance with manufacturers recommendations, but cumulative crank-rest timing shall not be less than 75 seconds.
4. In the event of engine failure, the panel shall close alarm circuit, indicate the fault on the appropriate lamp and shut down the engine. The panel shall include a manual reset switch so that the panel can be reset immediately after a fault condition. Reset devices that require a waiting period are not acceptable.

I. Options and accessories shall include the following:
1. Housing: The complete engine generator set shall be enclosed in a free-standing weather protective, aluminum (0.063-inch) panel construction housing with lockable, removable hinged door panels, hinged instrument panel door and panel light. Housing shall be wind rated to a minimum150 mph.
a. All parts shall be adequately protected against oxidation and corrosion and finish painted with durable machinery enamel, minimum of 3 mils applied in a maximum of 1-1/2 mils per application.
b. Include within the enclosure a switched 12 or 24-Volt LED luminaire on each side of the engine and a GFCI receptacle.
c. The enclosure must maintain the engine and generator at 40°F or be equipped with space heaters to maintain starting batteries between 50°F and 90°F.
2. 12V or 24-volt battery starting with maintenance free lead acid batteries with dual rate solid state automatic battery charger, with equalize timer, low and high battery voltage indicators and alarm terminals, charger malfunction indicator and alarm. Batteries shall be capable of providing two 45 second continuous cranking cycles. Provide battery racks, and charger shall be protected from any other charging source.
3. Muffler, critical silencing, with condensation drain; stainless steel flexible exhaust connector. Silencer shall mount horizontally on structural support inside of housing with 90° elbow termination with rain cap.
4. Premium exhaust rain cap, cast aluminum, stainless steel hardware, brass

bushing hinge.

5. Gas line accessories as required for the set to include but not limited to gas line strainer, 12" braided metallic flexible fuel line, battery power operated gas line shut-off solenoid valve, pressure reducing regulator fuel pressure gauge.
   a. Contractor shall provide natural gas fuel piping for the emergency generator set. Contractor shall install natural gas line fittings obtained from electrical contractor (as supplied with the engine generator). Plumbing line work for natural gas for the engine generator shall be with as few elbows and bends as possible (as near a straight line run from the gas supply tee-off as possible).
6. Coolant heater, 120VAC, 1 phase, 1000-2500 watts.
7. Unit mounted emergency shut-off mushroom type pushbutton switch.

J. Testing: The unit shall be given a complete shop test before shipment. It shall be installed on the job under supervision of the manufacturer's representative and shall receive start-up / commissioning service from that representative.
1. The unit shall be started cold and run for a one-hour test with building load connected. Provide additional load bank as required to achieve 100 percent loading.
2. Retransfer the load after test.
3. After this test, the set shall cool for five minutes, then must start and carry full building load for four hours.
4. Demonstrate the cranking cycle and all engine safety devices. The Owner’s authorized representative shall be instructed in the operation and maintenance of the unit.

K. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings and wiring diagrams. Three copies of dimensional drawings and wiring diagrams shall be provided as specified.
1. Operating Instructions: Provide and install in a suitable enclosure operating instructions for the engine generator set.
2. Contractor shall fill the radiator with a combination of water and ethylene-glycol to protect the radiator to -20°F after completion of the test.

2.2 AUTOMATIC TRANSFER SWITCHES

A. Rating and Construction:
1. Refer to the project drawings for specifications on the sizes and types of transfer switch equipment, withstand and closing ratings, voltage and ampere ratings, enclosures and accessories. All transfer switches shall have switched neutrals and shall be electrically operated and mechanically held.
2. Automatic transfer switches shall be included in a factory assembly with bypass-isolation switch equipment for the emergency life safety branch, two-source type for bypassing to normal or emergency. Bypass isolation not required for equipment branch.
3. All transfer switches and accessories shall be UL listed and labeled, tested per UL Standard 1008, and CSA Approved, and comply with NEMA ICS 2-447. When protected by molded case breaker withstand and closing ratings shall not be less than the following RMS symmetrical amps at 600 VAC:

Switch Size in Amps	WCR @ 480 Volts
Up to 260	30,000
300 to 1000	65,000
1200	85,000
1600 and larger	100,000

4. Provide one of the following standard products:
   a. Onan OTPC Series as required
   b. Standby Generator System Manufacturer, provided as a complete system
   c. ASCO 300 Series
   d. Russelectric RMT/RMTD Series
   e. Zenith ZTSD Series
5. Electrical operation shall be accomplished by a momentarily energized single solenoid operating mechanism which receives power from the source to which the load is being transferred. Fuse or thermal protection of the main operator is prohibited. The operating transfer time shall be 1/6 of a second or less. Mechanical locking in each position shall be accomplished without the aid of permanent magnets, latching solenoid, or motor operators.
6. Operation shall be inherently double-throw whereby all contacts move simultaneously and with no programmed delay in a neutral position. Electrical spacing shall be equal to or exceed those listed in table 15.1 of UL 1008. Only those main contact structures specifically manufactured for transfer switch service shall be acceptable. An overload or short circuit shall not cause the switch to go to a neutral position.
7. Inspection of all contacts (movable and stationary) shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors. A manual operating handle shall be provided for maintenance purposes. The maintenance handle shall permit the operator to stop the contacts at any point throughout the entire travel to properly inspect and service the contacts when required.
8. All switches for systems with switched neutrals shall have fully rated neutral transfer contacts that momentarily interconnect the neutrals of the sources and load for 100 milliseconds maximum, during the transfer/retransfer operation. The neutrals shall remain so interconnected until the line contacts close on the alternate source. Line and neutral contacts shall be driven by a single main operator.

B. Controls and Accessories:
1. Controls shall provide for the automatic starting sequence of the generator set.
2. Automatic controls shall signal the engine-generator set to start upon signal from normal source sensors. Solid state time delay start, adjustable from 0 to 5 seconds (factory set at 2 seconds) shall avoid nuisance start-ups. Battery voltage starting contacts shall be gold, dry type contacts factory wired to a field wiring terminal block.
3. The switch shall transfer when the emergency source reaches the set point voltage and frequency. Provide a solid-state time delay on transfer, adjustable from 0 to 120 seconds.
4. The switch shall retransfer the load to the normal source after a time delay retransfer, adjustable from 0 to 30 minutes. Retransfer time delay shall be immediately bypassed if the emergency power source fails.
5. Control shall be solid state and designed for a high level of immunity to power line surges and transients, demonstrated by test to IEEE Standard 587-1980. The control shall have optically isolated logic inputs, high isolation transformers for AC inputs, and relays on all outputs. Control shall be quick disconnect for ease of service.
6. Automatic transfer switches shall have inherent phase balance protection logic to detect a ‘single phasing’ Solid state undervoltage sensors shall simultaneously monitor all phases of both sources. Pick-up and dropout settings shall be adjustable. Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase. Voltage sensors shall have field calibration of actual

supply voltage to nominal system voltage. The transfer switch controller shall be equipped with a fault output terminal interconnected to a 24Vdc shunt trip, integral to the transfer switch and with built-in time delay, that functions to disconnect the utility source from the load should the standby emergency source fail to start.

7. For transfer switches serving non-disconnected motor loads, equip with a field adjustable time delay during switching in both directions, during which time the load is isolated from both power sources, to allow load residual voltage to decay before closure to the opposite source. The delay feature shall have an adjustable range covering 0 to 7.5 seconds. Transfer switches serving life safety equipment shall have this time delay set at 0 at startup/commissioning.
8. Controls shall signal the engine-generator set to stop after a time delay, adjustable from 0 to 10 minutes, beginning on return to the normal source.
9. Power for transfer operation shall be from the source to which the load is being transferred.
10. The control shall include latching diagnostic indicators to pinpoint the last successful step in the sequence of control functions, and to indicate the present status of the control functions in real time.
11. The control shall include provisions for remote transfer inhibit and area protection.
12. Provide front panel devices mounted on cabinet front consisting of:
    a. A key operated selector switch to provide the following positions and functions:
        1) Test - Simulates normal power loss to control for testing of generator set. Refer to Part 3 for programming requirements.
        2) Normal - Normal operating position.
        3) Retransfer - Momentary position to override retransfer time delay and cause immediate return to normal source, if available.
13. Exerciser Clock: Provide solid state exerciser clock to set the day, time, and duration of generator set exercise/test period. Provide a with/without load selector switch for the exercise period. Refer to Part 3 for programming requirements.
14. Provide Phase Sequence Monitor/Balance Module to protect against inadvertent phase rotation hookup and monitor for voltage phase imbalance between phases.
15. Each transfer switch shall be provided with a control panel to allow the operator to view the status and control operation of the transfer switch. The control panel shall be a sealed membrane panel rated NEMA 3R/IP53 or better (regardless of enclosure rating) that is permanently labeled for switch and control functions. The control panel shall communicate with the engine generator, including display of all engine and alternator data, and other transfer switch data in the power system. The control panel shall allow starting and stopping of the generator set via the transfer switch control panel in both test and emergency modes.

2.3 BYPASS ISOLATION AUTOMATIC TRANSFER SWITCH

A. For bypass-isolation equipment for life safety branch and as shown on the drawings, or where required by Code, provide one of the following standard products:
    1. Onan BTPC Series
    2. Kohler KB Code Series
    3. ASCO 948/962 Series
    4. Russelectric RTB
    5. Zenith ZBTS Series

B. A two-way bypass-isolation switch shall provide manual bypass of the load to either

source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven. Arrangements using electrically driven contacts are prohibited.

C. The bypass handle shall provide three operating modes: "Bypass to Normal", "Automatic", and "Bypass to Emergency". Bypass to the load carrying source shall be effected without any interruption of power to the load (make before break contacts). The operating speed of the bypass contacts shall be the same as that of the associated automatic transfer switch and shall be independent of the speed at which the manual bypass handle is operated. In the Automatic mode, the bypass contacts shall be out of the power circuit so that they will not be required to carry fault currents to which the system might be subjected.

D. Provide three operating modes on the isolation handle: "Closed", "Test", and "Open". The "Test" mode shall permit testing the entire emergency power system and automatic transfer switches without any interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the Open mode it shall be possible to withdraw the automatic transfer switch for inspection or maintenance in accordance with code requirements without removal of power conductors.

E. When in the Test or Open modes the bypass switch shall function as a manual transfer switch allowing transfer and retransfer of the load between sources without load regenerating voltage feedback to the transfer switches. This transfer/retransfer operation shall comply with paragraph 32.7 of UL 1008.

F. The bypass-isolation automatic transfer switch shall be supplied in a common Type I enclosure. The complete system shall be factory assembled and tested prior to shipment. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass isolation switch. All control inter-wiring shall be provided with disconnect plugs.

G. A visual position indicator shall be provided to indicate bypass-isolation switch positions. Pilot lights shall indicate availability of power sources and automatic transfer switch position. A prominent and detailed instruction plate shall be furnished.

2.4 REMOTE ANNUNCIATION PANEL

A. Locate next to ATS. Provide flush mounted with stainless steel plate containing the following:
   1. Trouble sonnet horn with silence switch.
   2. Illuminated annunciators with nameplates in accordance with the following table:

Lamp Legend	Generator Set Condition Indicated	Light	Audible Alarm
High Battery Voltage	Battery charger too high	Red	No
Low Battery Voltage	Battery voltage too low	Red	No
Normal Battery Voltage	Battery voltage ok	Green	No
Generator Running	Generator has output voltage	Green	No
Normal Utility Power	Utility power supplying the load	Green	No
EPS Supplying Load	Genset supplying the load	Green	No
Pre-Low Oil Pressure	Oil pressure approaching low limit	Yellow	Yes
Low Oil Pressure	Engine has shut down due to low oil pressure	Red	Yes
Pre-High Coolant Temp.	Temperature of coolant approaching	Yellow	Yes

Lamp Legend	Generator Set Condition Indicated	Light	Audible Alarm
	high limit		
High Coolant Temp.	Genset has shut down due to high coolant temp.	Red	Yes
Low Engine Temp.	Engine heater has malfunctioned	Red	Yes
Overspeed	Engine has shut down due to overspeed	Red	Yes
Overcrank	Engine failed to start	Red	Yes
Not In Auto	Engine control switch not in AUTO position	Flashing Red	Yes
Battery Charger Malfunction	Charger is signaling a failure	Red	Yes
Low Fuel	Fuel level below preset minimum	Red	Yes
Fault	Customer preselected condition	Red	Yes

B. Name plates shall be laminated black with white letters engraved. Letter size shall be a minimum of 3/8” high.

C. Illuminated annunciators shall be 1 inch minimum.

2.5 ELECTRICAL AND MECHANICAL PERFORMANCE

A. The switch must comply with UL 1008 and NEMA Standard Publication ICS 2-447. In addition, the switch must meet or exceed the following requirements and if so requested, be verified by certified laboratory test report.
1. Temperature Rise: Measurements shall be made after the overload and the endurance tests.
2. Withstand: UL listed to withstand the magnitude of fault current available at the switch terminals when coordinated with respective protective devices at an X/R ratio of 6.6 or less. The main contacts of the transfer switch shall not trip open or weld when subjected to fault currents.
3. Dielectric: Test, following the withstand current rating test, at 1960 volts AC rms minimum.
4. Transient Withstandability: Control panel voltage surge withstand capability test per IEEE Standard 472-1974 and voltage impulse withstand test per NEMA Standard publication ICS-1-109.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install standby engine driven generator set where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices, to ensure that the set complies with the specified requirements and serve the intended purposes. Provide and install in a Plexiglas enclosure complete operating instructions for each type of transfer switch.

B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of standby engine-driven generator sets and accessories.

C. Vibration Isolation:
1. Outside Mounted: Ribbed Neoprene Vibration Isolation
2. Roof Mounted: Install units on properly sized spring-type vibration mounts and ribbed Neoprene vibrations isolators.

3. Generator installed inside building: Install units on properly sized spring-type vibration mounts and ribbed Neoprene vibration isolators.

D. Concrete Pad: Install generator set on a reinforced concrete pad. The generator pad shall extend 6" beyond the generator set base, unless shown otherwise. Furnish the exact position of any block outs, mounting bolts, and the dimensions and location of the generator pad in a timely manner so as to prevent delay of the concrete work. Refer to Section 26 05 00 for housekeeping pads and Division 3 for Concrete Work.

E. Options and Accessories: Provide circuits, conductors, and raceways as required for generator options and accessories as required and specified. Provide separate dedicated circuits from the emergency branch circuit panel board to the generator for (1) engine/ coolant heaters, (2) GFCI convenience receptacle(s), (3) battery charger (LED work lights on battery), etc. Provide additional circuits as required, for a fully operational system.

F. Provide remote alarm annunciator. Coordinate final location of annunciator with Owner / Architect prior to installation. It shall be installed near ATS.

G. Provide dry contacts and outputs to monitor transfer switch and generator alarm conditions and notify Owner's Police or security personnel, and building management controls system and personnel, both when transfer to emergency occurs and when transfer to normal occurs.

H. Adjust main output circuit breaker(s) adjustable trip setting based on manufacturer's fault current and coordination analysis or as directed by Engineer.

3.2 GROUNDING

A. Install the generator as a separately derived system. Ground the generator neutral to the generator frame. Ground the generator frame to the building grounding system and provide a driven ground electrode at the generator location.

3.3 CONTROLS

A. Provide generator start-up control wiring and raceway from each automatic transfer switch to the respective standby generator set as required.

3.4 TESTING

A. Notify Owner's Commissioning Authority (CxA) prior to performing any tests so the CxA may witness tests at his/her discretion. Refer to Section 26 01 00 Commissioning of Electrical Systems. Testing shall be witnessed by owner and Engineer.

B. Provide testing in accordance with NFPA 110. Upon completion of installation of engine-driven generator set and after building circuitry has been energized with normal power source. Provide manufacturer's start-up service to test emergency power system to demonstrate standby capability and compliance with specified requirements, including automatic start-up, controls and full load acceptance. Test shall include operation of standby power system with voltage check while the system is loaded to ensure proper operation of the emergency generator, transfer switches, and other system components. Operation of the system shall simulate standby power conditions, that is, loss of main electrical power to the building. Test period shall be trouble-free operation with at least four automatic transfer switch operations (each switch) within the period of operation.
1. The unit shall be started and run for 30-minute break-in period at no-load unless recommended otherwise by manufacturer.

2. The unit shall be started cold and run for a four-hour test with building load connected and load bank to achieve 90 percent of rated generator capacity. Monitor and record available natural gas pressure and verify supply is adequate and stable during the entire test.
3. Retransfer the load after test.
4. After this test, the set shall cool for five minutes, then must start and carry 90% rated capacity load for four hours.
5. Provide additional Owner witnessed testing for all ancillary equipment on generator. Demonstrate all specified functions and alarms.
6. Demonstrate the cranking cycle and all engine safety devices. The Owner's authorized representative shall be instructed in the operation and maintenance of the unit. Provide minimum 4-hours training at each campus for 4-persons; one hour on four separate days

C. Contractor shall furnish all instruments, load banks, and personnel required for test. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include date and time of test, relative humidity, temperature and weather conditions.

3.5 MISCELLANEOUS

A. Provide circuits and receptacles to serve loads as directed by Owner / Architect, including, but not limited to:.
1. Telecommunications equipment
2. Public Address Communication & Master Clock System
3. Fire Detection Alarm and Signaling Systems including remote transponder panels and alarm power supply panels
4. Security Systems including remote power supplies (except for battery powered access control door hardware)
5. Video Surveillance CCTV System including remote camera power supplies
6. All receptacles and outlets in MDF/IDF rooms.
7. Technology MDF/IDF room dedicated HVAC equipment
8. Walk-in coolers/freezers and selected reach-in refrigeration equipment
9. Clinic refrigerator and selected clinic receptacles
10. Building Access control System including remote power supplies, except do not power door electric strike or hinge hardware on emergency power.
11. Owner’s Radio Base Station and handset charging equipment / Radio Repeaters / Distributive Antennae Systems (DAS)
12. Elevators, ADA chair/personnel lifts
13. Point of Sale Stations
14. Kitchen Manager’s Workstation
15. Building Management and Control System (BMCS)
16. Special education receptacles, minimum one in each room.
17. First responder Bi-Directional Distributive Antennae System (DAS) Systems

B. Mount annunciator alarm as directed by Owner / Architect. Coordinate final location of ATS with Owner / Architect prior to installation. Install next to ATS.

3.6 PROGRAMMING

A. Program automatic transfer switches for delayed transfer to emergency and sequential operation to transfer loads by priority based on manufacturer recommendation or as indicated below:
1. Life Safety Loads – less than 10 seconds
2. Critical Loads – more than 15 seconds, less than 30 seconds
3. Equipment Loads – more than 40 seconds, less than 60 seconds

4. Non-Legally required loads – more than 75 seconds, less than 120 seconds

B. Program automatic transfer switch voltage and frequency pick-up and drop out for load shedding based on load priority for voltage and frequency based on manufacturer recommendations or as indicated below:
1. Life Safety pick-up 10%; drop out 20%
2. Critical Loads pick-up 10%; drop out 15%
3. Equipment Loads pick-up 8%; drop out 15%
4. Non-Legally required loads pick-up 5%; drop out 10%

C. Exerciser clock: Program automatic transfer switch exerciser clock for generator to run every Tuesday, 8:00 AM, for 15-miniute run time, without load. Verify with Owner.

D. Test switch: Program automatic transfer test switch for generator to run with load, for minimum 30-miniutes to comply with NFPA 110 requirements for monthly testing. Maximum test time shall not exceed 35-miniutes unless directed otherwise by Owner.

E. Program engine cooldown time as recommended by the manufacturer.

3.7 TRAINING

A. Provide 4 hours training, one hour each for four persons, four separate days.

END OF SECTION 26 32 13

SECTION 26 32 16 DUAL PURPOSE MANUAL TRANSFER SWITCHES WITH INTEGRATED LOAD BANK AND GENERATOR QUICK CONNECTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Furnish and install manual transfer switches with 4-poles, amperage, voltage, and withstand current ratings as shown on the plans or as required. Each manual transfer shall consist of a 3-position center off mechanically held power transfer switch unit and a mechanical operating mechanism to provide complete manual operation. Each manual transfer switch shall include integrated load bank and generator quick disconnects. All manual transfer switches and mechanical operating mechanism shall be the product of the same manufacturer.

1.2 RELATED DOCUMENTS

A. The Conditions of the Contract and applicable requirements of Division 1 and Section 26 05 00 govern this Section.

1.3 Acceptable Manufacturers

A. Basis of design: ASCO Series 300.

B. Alternate manufactures:
1. Trystar
2. PSI Power and Controls

1.4 Codes and Standards
The manual transfer switches and accessories shall conform to the requirements of:

A. UL 1008 Listed for Optional Standby Transfer Switches (Manual Transfer Switches)

B. UL 891 Switch Boards

C. CSA C22.2 No.178 –1978

D. EC 60947-6-1 Low – Voltage Switchgear and Controller

E. PA 70 - National Electrical Code

F. FPA 99 – Essential Electrical Systems for Health Care Facilities

G. EEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

H. UL 508 Industrial Control Equipment

I. NEC Article 700

J. International Standards Organization ISO 9001

K. RoHs compliant (Restriction of Hazardous Substances)

L. Seismic qualification – International Building Code & OSHPD to SDS level of 2.5

1.5 QUALITY ASSURANCE

A. NEC and NFPA Compliance: Comply with applicable portions of the NEC (NFPA 70) including, but not limited to, emergency and standby power generation systems.

B. IEEE Compliance: Comply with applicable Institute of Electrical and Electronics Engineers, Inc. (IEEE) standards pertaining to generator construction.

C. Supplier: All equipment provided shall be supplied by an authorized distributor of the manufacturer who has been continuously engaged in the distribution of industrial grade Power System products for a minimum of 10-years. The supplier shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier is to be authorized to perform warranty service on all products provided.

1.6 SUBMITTALS

A. Submittal drawings and information on the manual transfer switches including installation drawings, wiring diagrams, dimensions, weights, etc. shall be provided. Full descriptive information on accessory items shall be furnished. Indicate:
1. Detailed dimensions for equipment footprint, front, rear, and side elevations.
2. Conduit entrance locations and requirements and restrictions.
3. Enclosure material, finish, and NEMA classification type.
4. Nameplate legends.
6. Metering and control wiring details.
7. Electrical characteristics including voltage, ampacity, overcurrent device frame size and trip ratings, withstand ratings, and time current curves of all overcurrent devices and components.

B. Submit manufacturers' "Installation, Start-Up and Service" instructions, recommended conductors, overcurrent protection, and electrical interlocks.

C. Submit recommended clearance dimensions.

D. Submit sequence of operation in narrative form.

E. Instruction Data and Drawings: Commercial type operating instructions shall be provided consisting of operating and maintenance manuals, parts books, dimensional drawings, and wiring diagrams.

1.7 WARRANTY

A. Provide one-year parts and labor warranty from date of substantial completion.

PART 2 - PRODUCTS

2.1 Mechanically Held Transfer Switch

A. The manual transfer switch unit shall be manually operated and mechanically held. The switch shall be mechanically interlocked to ensure only one of three possible positions, Source 1, Source 2, or Center Off. Fused disconnect type switches shall not be acceptable.

B. The switch shall be positively locked and unaffected by momentary outages so that

contact pressure is maintained at a constant value and temperature rise at the contacts is minimized for maximum reliability and operating life.

C. All main contacts shall be silver composition. Switches rated 600 amperes and above shall have segmented blow-on construction for high withstand current capability and be protected by separate arcing contacts.

D. Inspection of all contacts shall be possible from the front of the switch without disassembly of operating linkages and without disconnection of power conductors.

E. Transfer switch designs utilizing components of molded-case circuit breakers, contactors, or parts thereof which are not intended for continuous duty, repetitive switching, or transfer between two active power sources are not acceptable.

F. Neutral conductors shall be switched to electrically isolate the permanent generator from the temporary generator. The manual transfer switch shall be provided with fully- rated neutral transfer contacts.

G. The manual transfer switch shall be tested in accordance with UL 1008 for transfer switches. Switch ratings of 260 Amperes and less shall have endurance rating of 6000 cycles, 400 Ampere shall have endurance rating of 4000 cycles, and 600 – 3000 Amperes shall have endurance rating of 3000 cycles.

2.2 MANUAL OPERATIONS PROVISIONS

A. The manual transfer switch shall be arranged for manually actuated manual operation.

B. The manual transfer shall be actuated via a mechanical operating mechanism.

C. The manual operating handle shall be capable of external operation without opening the enclosure door.

D. It shall have the same contact to contact speed as would be for automatic operation.

E. There shall be three positions for manual operation:
1. Connected to Source 1 (preferred)
2. Connected to Source 2 (alternate)
3. Connected to center off (disconnected position)

F. Switch position when connected to Source 1, or Source 2 shall be pad – lockable.

2.3 ENCLOSURE

A. Manual transfer switches located outdoors shall be furnished in a NEMA type 3RX type 316 stainless steel enclosure. Manual transfer switches located indoors shall be NEMA 3R.

B. Enclosures shall be wall mounted or free-standing floor or pad mounted.

C. NEMA 3R enclosures shall be code gauge steel as per UL 50 with ANSI #61 powder coat finish.

D. 3RX enclosures shall be 316 stainless steel.

E. Provide strip heater with thermostat for Type 3R and 3RX enclosure requirements.

2.4 MECHANICAL AND ELECTRICAL PERFORMANCE

A. Mechanical position indicators (yellow) visible to the operator shall be included for Source 1 (preferred), Source 2, (alternate), and Center Off (disconnected).

B. Auxiliary position indicating contacts, rated 10 amps, 250 Vac shall be provided consisting of one closed when the manual transfer switch is connected to Source 1 (preferred), and one contact closed when the manual transfer switch is connected to Source 2 (alternate).

C. A form A contact shall be provided to indicate switch is in the Center Off (disconnected) position.

D. A Load Dump disconnect circuit breaker shall be provided between source 1 of the manual transfer switch and the 16 Series Outlets for Load Bank Connection. Load Dump circuit breaker shall include shunt trip and be sized for the full rating of the manual transfer switch and capable of carrying, at minimum, the full kW rating of the permanent generator for a minimum of 4-hours. Provided ground fault (GFI) protection for circuit breakers rated 800 Amperes or larger. Load dump disconnect circuit breaker shall be Square D, or the same manufacture as the building's main service disconnect equipment.

E. Auto Start Destination Toggle Switch shall be provided to allow for the user to select which generator the ATS will start when the engine start signal is sent from the building automatic transfer switch.

F. The Dual-Purpose Manual Transfer Switch integrated quick connects shall provide a connecting means for connecting a portable generator or a load bank.

G. Generator quick connects:
1. For 400A and below models, there shall be one (1) row of up to five (5) single pole connections.
2. For 600A - 800A models, there shall be two (2) rows of up to five (5) single pole connections.
3. For 1000A-1200A models, there shall be three (3) rows of up to 5 single pole connections.
4. For 1600A models, there shall be four (4) rows of up to 5 single pole connections.
5. For 2000A models, there shall be five (5) rows of up to 5 single pole connections.
6. For 2500A models, there shall be seven (7) rows of up to 5 single pole connections.
7. For 3000A models, there shall be eight (8) rows of up to 5 single pole connections.

H. Neutral connections are not required for Load Bank connections:
1. For 400A and below models, there shall be one (1) row of up to four (4) series single pole connections.
2. For 600A - 800A models, there shall be two (2) rows of up to four (4) single pole connections.
3. For 1000A-1200A models, there shall be three (3) rows of up to four (4) single pole connections.
4. For 1600A models, there shall be three (3) rows of up to 4 single pole connections.
5. For 2000A models, there shall be five (5) rows of up to 4 single pole connections.
6. For 2500A models, there shall be seven (7) rows of up to 4 single pole

connections.

7. For 3000A models, there shall be eight (8) rows of up to 4 single pole connections.

I. All electrical quick connectors shall be 16 Series cam type single pole connectors; color coded as per local industry standard practice:
   1. 240V and below: phase 1 = black, phase 2 = red or orange for hi-leg, phase 3 = blue (if required).
   2. 480V: phase 1 = brown, phase 2 = purple or orange, phase 3 = yellow.
   3. Ground shall always be green.
   4. Neutral shall always be white.
   5. A minimum of 25% phase ampacity shall be provided for ground connections for portable generator and load bank connections.

2.5 ACCESSORIES

A. Enclosure Heater(s): A 125-watt enclosure heater with transformer and thermostat (adjustable from 30° to 140 degrees F) shall be provided for outdoor installations where type 3R or 3RX, enclosures are specified. (This feature shall be equal to ASCO accessory 44G and shall be capable of being added to existing switches). Thermostat shall be set to 40-degrees F.

B. Surge Suppression – A SPD with a surge current rating of 65kA shall be provided with individually matched fused metal oxide varistors (MOVs). It shall include LED status indication of normal operation, under voltage, power loss, phase loss or component failure. Shall include form C dry contacts for external alarm or monitoring. The unit shall be enclosed in a Noryl housing rated NEMA 4, 12, and 4X. Shall comply with UL 1449 latest edition. (This feature shall be equal to ASCO accessory 73).

C. Shunt Trip Option on the Load Bank Breaker- 119LC - 24VDC Shunt Trip on the manual transfer switches load bank breaker to integrate with building automatic transfer switch. Load dump upon loss of utility source or automatic generator start signal from the automatic transfer switch. Circuit breakers 800 Amps and larger shall include GFI, Ground Fault Interrupter.

D. Power Meter - ASCO 5210 Power Meter Connected to Load Side (135L)

E. Accessory 171EP Base Package Bundle – Two form C contacts shall be connected to a terminal block that operate when Source 1 and Source 2 voltage is present at manual transfer switch terminals. The following indicators shall be provided:
   1. Load Connected to Source 1 (Green).
   2. Load Connected to Source 2 (Red).
   3. Source 1 Available (Green).
   4. Source 2 Available (Red).
   5. Load Disconnect (Yellow)
   6. Phase Rotation Monitor
   7. Maintained Engine Start Switch and Common Alarm LED/Contact

2.6 WITHSTAND AND CLOSING RATINGS

A. The Manual Transfer Switch shall be rated to close on and withstand the available RMS symmetrical short circuit current at the terminals with the type of overcurrent protection shown on the plans.
   1. Source 1 WCR ratings @ 480v shall be as follows when used with specific circuit breakers or current limiting fuses:

MTDQ Size	Source 1 Withstand & Closing Rating MCCB	Source 1 W/CLF
150A - 600A	50,000A	200,000A
800A - 1200A	50,000A	200,000A
1600A - 2000A	65,000A	200,000A
2500A - 3000A	100,000A	200,000A

2. Source 2 WCR ratings @ 600V shall be as follows when used with any molded case circuit breaker:

MTDQ Size	Source 2 Withstand & Closing Rating MCCB at Source Wired to Quick Connects
105A - 600A	22,000A
800A - 1200A	22,000A
1600A - 2000A	65,000A
2600A - 3000A	100,000A

2.7 TESTS AND CERTIFICATION

A. The manual transfer switch shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The manual transfer switch manufacturer shall be certified to ISO 9001: 2008 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001: 2008.

2.8 SERVICE REPRESENTATION

A. The manual transfer switch manufacturer shall maintain a national service organization of company- employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of switch shipments, by serial number, for a minimum of 20 years.

C. For ease of maintenance, the manual transfer switch nameplate shall include drawing numbers and serviceable part numbers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install manual transfer switches where shown, in accordance with the equipment manufacturer's written instructions and recognized industry practices to ensure that the transfer switch complies with the specified requirements and serve the

intended purposes. Provide and install complete operating instructions in a Plexiglas enclosure for each type of transfer switch inside the enclosure.

B. Standard: Comply with NEMA standards, requirements of the NEC, and applicable portions of NECA Standard of Installation pertaining to installation of manual transfer switches.

C. Concrete Pad: Install free-standing floor or pad mounted manual transfer switches on a reinforced concrete pad. The pad shall extend 6" beyond the manual transfer switch base, unless shown otherwise. Furnish the exact position of any block outs, mounting bolts, and the dimensions and location of the manual transfer switch pad in a timely manner so as to prevent delay of the concrete work. Refer to Section 26 05 00 for housekeeping pads and Division 3 for Concrete Work.

D. Provide circuits, conductors, and raceways as required for manual transfer switch options and accessories as required or specified. Provide separate dedicated circuits from the emergency branch circuit panel board to the manual transfer switch when required for indicated options or accessories. Provide control circuits from building automatic transfer switch to load bank shunt trip circuit breaker for load bank dump upon loss of building utility power.

E. Provide shunt trip control of load bank circuit breaker to dump the load bank load if the building automatic transfer switch loses utility power.

3.2 GROUNDING

A. Ground the manual transfer switch to the building grounding system and provide a driven ground electrode at the manual transfer switch location or bond to the building grounding system ground rod(s) if in close proximity.

3.3 CONTROLS

A. Provide manual transfer switch load dump control wiring and raceway from the automatic transfer switch to the load bank shunt trip circuit breaker to dump the load bank load upon generator start signal from the building automatic transfer switch(es).

3.4 TESTING

A. Notify Owner’s Commissioning Authority (CxA) prior to performing any tests so the CxA may witness tests at his/her discretion. Refer to Section 26 01 00 Commissioning of Electrical Systems. Testing shall be witnessed by owner and Engineer.

B. Coordinate testing of manual transfer switch with the testing of the permanent generator source and associated automatic transfer switches, including the generator load bank test.

C. Contractor shall furnish all instruments, load banks, and personnel required for test. Submit 4 copies of certified test results to Architect/Engineer for review. Test reports shall include date and time of test, relative humidity, temperature, and weather conditions.

D. Pre-energization checks: Before energizing, check for continuous of circuits and for short circuits.

E. Ground Fault Interrupter (GFI) test for load bank circuit breakers 1,000 Amps and larger: After completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both

current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 20 percent of overcurrent device rating or 600 Amperes, whichever is lower.

E. Provide thermal infrared scan of the manual transfer switch under full load as directed and witnessed by Owner. Correct any deficiencies causing abnormal heating and repeat the scan. Provide digital video documentation with deficiencies corrected for comparison to future test. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to close out and make corrections prior to close-out.

F. Submittals: Furnish instruments and personnel required for tests. Submit 4 copies of certified test results to the Architect for review. Test reports shall include switchboard tested, date and time of test, relative humidity, temperature, and weather conditions.

3.5 TRAINING

A. Provide four hours training, one hour each for four persons, four separate days. Coordinate with the Owner for manual transfer switch training which may coincide with any other related or required generator or automatic transfer switch training.

END OF SECTION 26 32 16

SECTION 26 43 00 SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Surge Protection Device (SPD) covered under this section includes service entrance type surge protection devices suitable for use as Type 1 or Type 2 Devices per UL1449 5th Edition, applied to the line or load side of the utility feed inside the facility. SPDs shall be connected in parallel with the facility's wiring system. The unit shall be manufactured in the USA by a qualified manufacturer of suppression filter system equipment, which has been engaged in the commercial design and manufacture of such products for a minimum of five years.

B. Contractor shall provide all labor, materials, equipment, and incidentals as shown, specified and required to finish and install surge protection devices.

1.2 QUALITY ASSURANCE

A. Reference Standard: Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in this document:
1. UL 1449 Fifth Edition
2. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
3. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low-Voltage AC Power Circuits.
4. IEEE 1100 Emerald Book.
5. National Fire Protection Association (NFPA 70 (NEC), 75, and 78).
6. UL 1283 – Electromagnetic Interference Filters

B. When requested for verification, provide copies of the following:
1. Copies of actual let through voltage data in the form of oscilloscope results for both ANSI/IEEE C62.41 Category C3 (combination wave) and B3 (Ring wave) tested in accordance with ANSI/IEEE C6245.
2. Copies of test reports from a recognized independent testing laboratory, capable of producing 200kA surge current waveforms, verifying the suppressor components can survive published surge current rating on both a per mode and per phase basis using the ANSI/IEEE C62.41 impulse waveform C3 (8 x 20 microsecond, 20kV/10kA). Test data on an individual module is not acceptable.

1.3 SUBMITTALS

A. Submit shop drawings complete with all technical information for specific unit dimensions, let through voltage data, detailed installation instructions, maintenance manual, and wiring configuration.

B. Provide detailed marked-up copy of this specification with line-by-line compliance or exception statements to all provisions of this specification.

C. Copies of Manufacturer’s catalog data, technical information and specifications on equipment.

D. Copies of documentation stating that the Surge Protection Device is listed from a Nationally Recognized Testing Laboratory (NRTL) (UL, ETL, etc.) and are tested and

multi-listed to UL 1449 5th Edition and UL 1283.

F. Copy of warranty statement clearly establishing the terms and conditions to the building/facility owner/operator.

1.4 WARRANTY

A. The manufacturer shall provide a minimum 20-year warranty for high and very high exposure SPDs. Very high exposure unit warranties shall include exposure to temporary extended over-voltage conditions. Provide a minimum 15-year warranty for all medium exposure SPDs, and a minimum 10-year warranty for all other SPDs for parts from date of substantial completion against failure. Contractor shall assist the Owner with manufacturer warranty registration.

PART 2 – PRODUCTS

2.1 APPROVED MANUFACTURER

A. Low exposure, minimum 10-year parts warranty, minimum 50k Amps per mode, 100k Amps per phase, Type 1 and Type 2.
   1. Recessed mount panelboard extension with brushed stainless-steel front:
      a. ACT Communications:471- ###V-050-SS-F-PB flush series.
      b. ABB Current Technology PX3-050-VVV- #X-SF-X-F- # series.
      c. SSI Surge Suppression, Inc. CSMx12-FMPxSS series.
      d. SST Southern Tier Technologies T45-VVVV-50-AWAJ2-C-RKSS(Stainless Steel front).
   2. Branch panelboard surface mounted:
      a. ACT Communications 455 series.
      b. ABB Current Technology CG3 60 series.
      c. SSI Surge Suppression, Inc. CSMx12 series.
      d. SST Southern Tier Technologies T45-VVVV-50AWAJ2-C

B. Medium exposure, minimum 15-year parts warranty, minimum 120k Amps per mode, 240k Amps per phase, Type 2.
   1. ACT Communications 471 series.
   2. ABB Current Technology CGP3 125 series.
   3. SSI Surge Suppression, Inc. CSMx24 series.
   4. SST Southern Tier Technologies T45-VVVV-120A series

C. High exposure, minimum 20-year parts warranty, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD.
   1. ACT Communications 471 x200 series.
   2. ABB Current Technology TG3 200 series.
   3. SSI Surge Suppression, Inc. CHLxM series.
   4. SST Southern Tier Technologies T45-VVVV-200A series

D. Very high exposure at service entrance 1,201 Amps and above: Minimum 20-year parts warranty; minimum 200k Amps per mode; 400k Amps per phase, Type 1 and 2 SPD:
   1. ACT Communications 471 x200 SEL series.
   2. ABB Current Technology SEL3 200 series.

   The service entrance protector shall incorporate a combination of TPMOV and Selenium technology allowing for transient surge and temporary over voltage protection. The unit shall be able to prevent common temporary over voltages and high impedance faults from damaging the MOVs, increasing their longevity and ability to protect the critical load.

Limited and Intermediate current TOVs can be caused by a loss of the neutral conductor in a split phase or three phase power system. The available fault current will be determined by the impedance of the loads connected to the phases opposite the SPD and are typically in the range of 30A to 1000A. Minimum 20-year parts warranty, extended over-voltage protection, minimum 200k Amps per mode, 400k Amps per phase, Type 2 SPD. The Selenium elements must limit voltage to the MOV as a percent of nominal as outlined below:

Overvoltage seen by MOVs as % of Nominal				
	available current			
time	30A	100A	500A	1000A
1 cycle	120%	130%	150%	160%
10 cycles	130%	150%	160%	160%
30 cycles	140%	150%	160%	160%

*To verify damage to the MOVs has been mitigated, the percent overvoltage seen at the MOV must be less than 200% for split-phase applications or 173% for three-phase applications (100% is nominal).

2.2 MANUFACTURED UNITS / ELECTRICAL REQUIREMENTS

A. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal system operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL1449, section 37.7.3. MCOV values claimed based on the component's value or on the 30-minute 115% overvoltage test in UL1449 will not be accepted.

B. Unit shall have not more than 10% deterioration or degradation of the UL1449, Voltage Protection Rating (VPR) due to repeated surges.

C. Protection Modes SVR (6kV, 500A) and UL1449 VPR (6kV, 3kA) for grounded WYE/delta and High Leg Delta circuits with voltages of (480Y/277), (208Y/120), (600Y/347). 3-Phase, 4 wire circuits, (120/240) split phase shall be as follows and comply with test procedures outlined in UL1449: Values Depicted are based on a system Without Disconnect / With Disconnect

System Voltage	Mode	MCOV	C3 Wave	UL 1449 VPR Rating
120/240	L-N	150	650/775	700/800
120/208	L-G	150	650/825	700/900
	N-G	0	500/500	900/1000
	L-L	300	950/1250	900/1200
277/480	L-N	320	1125/1225	900/1200
	L-G	320	1075/1225	1200/1200
	N-G	0	900/900	1200/1500
	L-L	550	1950/2200	1800/1800

D. Electrical Noise Filter- each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric noise shall be as follows using the MIL-STD-220A insertion loss test method.
1. 14 dB from 10 kHz to 1 MHz.

E. Each Unit shall provide the following features:
1. Phase Indicator lights, Form C dry contacts, counter and audible alarm.
2. Field testable while installed.
3. High performance interconnecting cable.

4. The UL 1449 Voltage Protection Rating (VPR) shall be permanently affixed to the SPD unit.
5. The UL 1449 Nominal Discharge Surge Current Rating shall be 20kA
6. The SCCR rating of the SPD shall be 200kAIC without requiring an upstream protection device for safe operation.
7. The unit shall be listed as a Type 2 SPD per UL1449.
8. Power wiring: SPD shall be equipped with mechanical lugs that can accept up to #2 AWG wire on High Exposure units and up to #6 on Medium and Low Exposure units.

2.3 POWER CABLES FOR CONNECTION

A. Power wiring: Conductors between all high and very-high SPDs and switchgear shall be high performance interconnect system “Low Z Cable” cables with Ultra Low impedance characteristics at 10kHz and above.

B. High Performance Low Impedance cable shall be #6 AWG minimum for Very High, High, and Medium Exposure SPDs and #10 AWG minimum for Low Exposure SPDs.

PART 3 – EXECUTION

3.1 GENERAL INSTALLATION

A. The unit shall be installed as close as practical to the facility's wiring system in accordance with applicable national/local electrical codes and the manufacturer's recommended installation instructions. Connection shall be with high performance, low impedance cables in conduit and shall not be any longer than necessary, avoiding unnecessary bends. Minimum wire size and overcurrent protection device for disconnect shall be provided and as recommended by the manufacturer.

B. Units specified for lighting and appliance panel boards as panelboard extensions (EGPE) shall be mounted directly above or below the first section of the panel board it is protecting. Any other mounting location will not be acceptable and shall be corrected, without exception, at no additional cost to the Owner.

C. Units specified for panelboards, switchboards, or motor control centers shall be mounted directly above or adjacent to the panelboard, switchboard or motor control center using unistrut supports secured to structure as required. Conduit length between power distribution panelboard or switchboard shall be less than two inches. Mounting above equipment is not acceptable.

D. Overcurrent device and conductors for devices shall be the maximum recommended by the manufacturer. Manufacturer’s recommendations shall prevail over the information given in the plans and specifications.

E. Provide recessed mounted panelboard extension type enclosures for devices protecting recessed panelboards. Enclosure front shall match panelboard front material and finish. Provide brushed stainless-steel front at kitchens and food processing areas.

3.2 UNIT SELECTION BASED ON EXPOSURE LEVEL

A. (SPDVH) Provide very-high exposure SPDs with Selenium and TPMOV technology for the following new electrical equipment or where indicated:
1. Service entrance rated 1,201 Amps and above.

B. (SPDH) Provide high exposure SPDs for the following new electrical equipment or where indicated:
   1. Service entrance rated 801 – 1,200 Amps.
   2. Switchboards located outside.

C. (SPDM): Provide medium exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 401 - 800 Amps.
   2. Panelboards above 600 Amps.
   3. Motor control centers.
   4. Non-service entrance switchboards.

D. (SPDL): Provide low exposure SPDs at the following new electrical equipment or where indicated:
   1. Service entrance rated 400 Amps and below.
   2. Panelboards 600 Amps and below.

3.3 TESTING

A. Factory Trained Representative shall provide start-up to include initial verification of proper installation, shortest cable connection, and initiate factory warranty. The technician will be required to do the following as a minimum:
   1. Verify the installation follows applicable national / local electrical codes related to SPDs and the manufacturer's Installation, Operation and Maintenance Instructions and recommendations.
   2. Verify overcurrent device rating.
   2. Verify all wiring connections and installation conforms to manufacturer’s recommendations.
   3. Record information for each product installed and include in O&M Manual

B. A copy of the Factory diagnostic test report and written approval of the installation shall be included with the Electrical Operating and Maintenance Manual. The Contractor shall make all adjustments, changes, corrections, etc. as required by the Factory Trained Representative so that the installation follows the manufacturer’s installation and operation instructions without additional charge to the Owner.

END OF SECTION 26 43 00

SECTION 26 51 13 LIGHTING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Work Included: Lighting fixture work is as shown, scheduled and specified.

B. Applications: The applications of lighting fixtures required for the project include the following:
1. General lighting
2. Emergency lighting
3. Outdoor area lighting

1.2 QUALITY ASSURANCE

A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.

B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.

C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.

B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

C. Submittal data shall include luminaire efficiency parameters.

D. Submittal data for exterior luminaries shall include IESNA BUG ratings, backlight, uplight, and glare ratings of each unique luminaire for the orientation and tile specified. Indicate total absolute lumens per luminaire and absolute lumens emitted above horizontal based by each luminaire for the orientation and tile specified.

1.4 WARRANTY

A. Provide 5-year warranty on all light fixtures, including internal or remote LED drivers, all other electrical internal electrical or electronic components except for emergency battery packs or emergency load control device relays. Refer to other specific component warranty requirements below.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for additional approved manufacturers.

1. Light fixtures:
   Acuity
   Signify
   Cooper Lighting Solutions
   HE Williams
2. LED Drivers:
   Philips
   Osram Optotronic
   Eldo LED
3. Emergency Battery Packs with self-testing drivers/inverters: Shall be the same manufacturer as the low voltage lighting controls provided on this project. Where there are no low voltage lighting controls specified or provided, the manufacturer shall be Bodine.
   Bodine
   Chloride
   Lithonia
   Dual Lite
   IOTA
4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible: Shall be the same manufacturer as the low voltage lighting controls provided on this project. Where there are no low voltage lighting controls specified or provided, the manufacturer shall be Bodine.
5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
   Bodine GTD20A

2.2 MATERIALS AND COMPONENTS

A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.

B. Fixture Types:

1. General:
   a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
   b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
   c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
   d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
   e. DLC, DLC Premium or Energy Star qualified unless specified otherwise.
   f. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
   g. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
   i. Color Rendering Index (CRI): ≥ 80 Indoor; ≥ 65 Outdoor

j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.
3. LED Exit Signs: Provide red lettering. Exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes. Edge-lit exit signs shall have a silver background so that “EXIT” cannot be read backwards from the opposite side.
   a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafetoriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light output at 90 minutes of battery operation. LED lamps.
5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.

C. LED drivers:
1. NEMA 410 compliant for in-rush current.
2. Starting Temperature: -40˚ F [-40˚ C].
3. Input Voltage: 120 to 480 (±10%) V.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF): ≥ 0.90.
7. Total Harmonic Distortion (THD): ≤ 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.

E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.

F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:
1. Bodine BSL-ST Series for OEM installation
2. Bodine BSL310-SI Series for field installation
3. Bodine ELI-S Series for line voltage sine wave inverter field installation

G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.

H. Emergency Generator / Inverter Load Control Device (ELC):
1. 16 Amp minimum ballast / driver load

2. Compatible with 0-10 Volt dimmer switches
3. UL 924
4. Minimum 3-year warranty
5. Integral or remove test switch.

I. Emergency Generator / Inverter branch circuit transfer switch:
1. UL 1008
2. 20 Amp ballast/driver load
3. 0-10Vdc dimming compatible

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.

B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.

C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.

D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.

E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner’s designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.

F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafetoriums and kitchens.

G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.

H. Install in accordance with manufacturers instructions.

I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.

J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.

K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.

M. Install recessed luminaires to permit removal from below.

N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.

O. Install wall-mounted luminaires at height as directed by Architect.

P. Install accessories furnished with each luminary.

Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.

R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaires.

S. Bond products and metal accessories to branch circuit equipment grounding conductor.

T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.

U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency load control devices (ELC). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or ELC circuit shall originate from same branch circuit breaker as switched lighting circuit.

V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.

W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.

X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Provide separate lighting contactors for:
1. Parking Lot Lighting
2. Building Mounted Lighting
3. Exterior Signage

Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.

Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.

AA. Lighting Fixture Supports:
1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.

2. Shall maintain the fixture positions after cleaning and relamping.
3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

BB. Hardware for surface mounting fixtures to suspended ceilings:
1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.

CC. Lighting Fixture Supports for aluminum canopies:
1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

3.2 TESTING

A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.

B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.

C. Final aiming and adjustment: Aim and adjust lighting fixtures for their intended purpose as specified or as required. Adjustments may include but not be limited to directional aiming, adjusting selectable lumen output, selectable correlative color temperature (CCT), selectable beam pattern, replacing/installing fixture manufacture’s optional optical lens used for adjusting beam patterns or for softening beam edges, replacing/installing manufacture’s optional theatrical/specialty color lens colors. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION 26 51 13

SECTION 26 55 61 ELEMENTARY/INTERMEDIATE SCHOOL THEATRICAL LIGHTING SYSTEM

PART 1 - GENERAL

1.1 INTENT

A. The intent of this specification is to define parameters for furnishing and installing a complete and working new dimming and control system. Performance deviations will not be accepted. One company shall be responsible for installing or coordinating the install of all aspects of the stage equipment. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, etc., necessary to complete installation of new stage equipment

B. All work must be done in compliance with the National Electric Code and applicable local codes.

C. Contractor is responsible for providing a complete and working system. All items needed for a complete and working system meeting the design intent of the plans and specifications are to be included, even if not specifically listed.

1.2 APPROVED EQUIPMENT

A. Dimming, Controls, and Fixtures:
1. Basis of design: Electronic Theatre Controls.
2. Strand Lighting

1.3 SUBSTITUTIONS

A. Specific items of equipment are listed by trade names. It is neither the purpose nor intent of these documents to eliminate competitive proposals.

B. Accompanying each request shall be a letter specifically detailing each substitution including catalog data, specifications, operative samples, technical information, drawings, performance and test data, and complete descriptive and functional information to assist in a fair evaluation. Substitution requests shall be submitted for each component of the lighting and rigging system and shall be evaluated separately. Requests shall also include a detailed line by line specification compliance letter. Any deviations from the specifications or drawings shall be listed and explained. Failure to submit any substitution for prior approval or not providing sufficient data for evaluation shall require the exact item specified to be furnished. Approval will be granted by Addenda Only.

C. Owner's approval of a substitution for bid purposes will not relieve the contractor from the responsibility of meeting all specification criteria. If an approval of a substitution is granted, the Contractor shall be fully responsible for any and all changes such substitution shall require.

1.4 QUALITY ASSURANCE

A. To ensure a complete uniform installation and single point of responsibility for system design and warranty, one manufacturer shall provide all dimming, rigging, control system and fixture components. Mixing of equipment brands will not be accepted.

B. Manufacturer shall provide local on-site service for the system for a period of two years from date of acceptance by the Owner. This person or firm must be regularly engaged in

the service of dimmers. A salesperson or sales agent without dedicated service personnel does not meet this requirement.

C. This specification details specific operational and functional needs of the Owner. Deviations from the performance requirements will not be accepted from any supplier. Contractor assumes the responsibility of removing any non-complying material discovered during the warranty period and replacing it with specification compliant equipment.

1.5 SERVICES

A. Services of qualified project manager, representing the manufacturer, and employed full time in the sales and service of control systems, shall be provided during the installation period to answer questions and review the installation.

B. Services of a qualified technician, representing the manufacturer, and employed full time in the service of control systems, shall be provided for one visit upon 21 days' notice. This technician shall terminate all low voltage control wiring, inspect the installation, energize the system, and program the architectural control system. He shall also instruct the Owner in proper operation and maintenance of the system.

C. During the warranty period, the manufacturer shall provide a toll-free 24-hour-per-day number for telephone technical support and service request.

1.6. DRAWINGS

A. Dimming System Manufacturer shall provide .pdf electronic files for submittals, including system risers, rack schedules, and manufacturer cut sheets for all equipment.

B. Dimming System Manufacturer shall provide .pdf electronic files for Operation & Maintenance Manuals, to include Operation Manuals for all supplied equipment.

1.7 WARRANTY

A. The dimming manufacturer shall provide a two (2) year warranty on the entire lighting system from date of acceptance.

B. The dimming manufacturer shall provide a five (5) year warranty on all LED light fixtures. The LED light array shall have a ten (10) year warranty.

1.8 SCOPE OF WORK

A. This section includes the following lighting control system equipment
1. Dimmers
2. Controls
3. Distribution
4. Lighting instruments, lamps, and associated portable equipment

B. Work under this section shall include the furnishing of all labor, materials, tools, transportation services, supervision, etc., necessary to complete the installation of new stage equipment as detailed in these specifications and accompanying documents.

C. The Project Electrical Contractor shall be responsible for the following, with performance requirements as specified in other Division 26 specifications:

1. Provide all dimming, control, and distribution equipment as detailed and required in these specifications and associated drawings
2. Installation of dead hung track and track mounted fixtures as required.
3. Installation of all dimming and control racks and equipment, including mounting of racks on walls, power feeds as required, and installation of custom back boxes.
4. Provision and installation of all standard back boxes
5. Provision, installation, termination, of all 120v distribution circuits, and all 120/208v feeder circuits for the theatrical lighting system
6. Provision and installation of all conduit, junction boxes, electrical wire ways, and cable trays as required for the lighting systems, including low voltage control systems.
7. Clean all racks, panels, and boxes of dirt, dust, and debris, re-assemble all equipment, and replace all panels, covers, and screws prior to time of system factory energization and training.
8. Coordination with the manufacturer on all aspects of the rigging and electrical installation and low voltage cable runs. Follow all manufacturer submittal plans and installation recommendations. Actively facilitate coordination with the General Contractor and Structural Engineer for all structural attachment needs. Schedule adequate time at the end of the job for manufacturer to commission the system before turnover to the owner.
9. At time of System Commissioning, Project Electrical Contractor is responsible for providing access to all low voltage termination points for termination and testing to the Service Technician. This includes lifts, ladders, and personnel required to reach any position the Service Technician needs access to. Electrical Contractor shall also provide personnel as needed to the Service Technician for troubleshooting and any needed wiring changes, terminations, or testing. This personnel shall be made available whenever the service technician is on the job site.
10. Electrical Contractor is responsible for advance scheduling with the startup technician with 21 days' notice of request for system startup. Electrical Contractor is responsible for having all equipment installed and wiring pulled & terminated prior to the arrival of the technician. If the jobsite is not ready when the technician has been scheduled to arrive, and additional trip(s) are necessary, the Electrical Contractor shall pay necessary additional trip charges at no additional cost to the Owner.

E. All components necessary to make the system a complete and working lighting system shall be provided.

F. Verify site conditions and system layout during the project approval process, coordinating with other trades as required.

1.9 SUBMITTALS

A. Submit product data for theatrical dimming equipment, controls, and fixtures.

B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

PART 2 – PRODUCTS

2.1 DIGITAL MINI PANELS

A. Mini Panels
1. Digital Panels for lighting and pluggable loads shall be the Foundry Mini Panel by ETC, Inc.
2. Mechanical
   a. Mini Panels shall be constructed of 16AWG steel and finished in a black fine-texture powder paint.
   b. The Mini Panel shall be no larger than 9” x 12” x 3.5” for 4 output models or 14” x 12” x 3.5” for 8 output models
   c. Mini Panels shall support wall and ceiling mounting, including installation in Plenum air return spaces.
   d. A removable dead front cover shall be mechanically fastened using four screws.
   e. An internal safety cover made of 16 AWG steel shall prevent access to all line voltage (class1) wiring and components without limiting access to low voltage terminations, changing settings during commissioning, or manual control of relays.
   f. Mini Panels shall support onboard configuration without the use of software using a simple two-button interface to set start address
   g. The Mini Panel shall support an input for use in UL 924 Emergency Systems.
      1) A dry contact input shall provide triggering of an emergency condition.
      2) A three-position switch shall set the input as Normally Open (NO) Normally Closed (NC), or Off.
      3) Load shedding shall be supported via a two-position switch per zone, that includes or excludes each zone from the UL924 input.
   h. The Mini Panel shall support a Demand Response input to automatically reduce overall power consumption.
      1) A dry contact input shall be supported to trigger the demand response condition.
      2) A single rotary dial shall be available for each to set the maximum trim level when the input is active.
   i. All configuration buttons shall be fully accessible when the panel is mounted, and the front panel is removed.
   j. Mini Panels shall provide the following LED indicators:
      1) UL924 Active (red)
      2) Demand Response Active (green)
      3) Power OK (blue)
      4) DMX Signal/Error (green)
3. Electrical
   a. Power Input shall support 120-277 Volts AC 47-63Hz for control electronics and for each independent zone. Daisy Chain of an input to multiple control zones shall be supported
   b. Mini Panels shall provide an optional 20A single-phase normal sense feed input for UL 924 Emergency Lighting Control Bypass
   c. A voltage barrier shall be available to separate normal and emergency circuits or lighting and plug loads when combined in a single Panel. The barrier shall be constructed of UL94-V-0 plastic
   d. All Mini Panels shall provide a 20 Ampere, fully rated, normally open relay for each output rated for lighting and plug load use
   e. A 0-10V dimming output per zone shall support 0-10V sink control rated for 100mA per output.

f. Mini Panels shall support Class 2, ANSI E1.11-2008, USITT DMX512A control communications.
   1) Mini Panels shall provide a DMX512A wiring connection using terminal blocks for #24 AWG wire.
      a) Terminal blocks for Cat5e or better wire shall also be available.
   2) The control network shall utilize unshielded twisted pair, Belden 9729 or equivalent wire, plus one #14 ESD drain wire (when not installed in grounded metal conduit). Use of Category 5e, or better, control network wiring shall also be supported when utilizing appropriate termination kits available from the manufacturer.

g. Mini Panels shall be designed and tested to withstand discharges up to 15,000 volts (IEC 801-2) without impairment of performance.

h. Mini Panels shall provide a three-position terminal for power input to the control electronics. The control power input shall accept 6-14AWG wire and be clearly marked Line, Neutral and Earth Ground

i. Each relay shall provide three screw terminals for line voltage power connection. Each terminal shall accept 6-14awg wire and be clearly labeled Input, Output and Thru. Panels that do not support a single power input to multiple discrete relays, in any combination, shall not be accepted.

j. Mini Panels shall support 0-10V dimming control via two 16-26AWG terminals for 0-10V+ and 0-10V common wiring connections.

k. Mini Panels shall be UL and cUL LISTED and conform to UL 508 and UL 2043 (Plenum rated) standards.

4. Functional

a. Mini Panels shall be available in 4 or 8 zone configurations with a 20 Ampere, fully–rated, relay output and 0-10V dimming per zone

b. Mini Panels shall be UL924 approved for emergency lighting circuits and shall activate only the selected outputs. Excluded loads shall be shed and not output during emergency conditions.

c. Mini Panels shall support Demand Response input via contact closure. Upon input the Panel shall reduce maximum output to 70% of peak usage. 0-10V outputs shall support Demand response maximum level threshold adjustment using a rotary fader and shall be assignable per circuit while measuring usage.

d. Upon loss of power, Mini Panels shall return to their last state when power returns.

e. Mini Panels shall support commissioning without the use of software or specialty configuration tools. Panels that require software for configuration shall not be acceptable.

f. All Mini Panels shall be configurable via ANSI E1.20 Remote Device Management (RDM). RDM parameters shall include:
   1) Device Label – configure a name for the device.
   2) DMX Start Address –set the starting DMX address of the Zone Controller to a value from 1-512.
   3) DMX Fail Mode (Data Loss) – configure the Zone Controller behavior when DMX is lost: Hold last look, Wait and fade, Go to full (default).
   4) Packet Delay – configure the number of packets required before the zone controller activates a change of level (relay on/off or 0-10V output).
   5) Mini Panels that are not configurable over RDM shall not be acceptable.

2.2 ECHO TOUCH CONTROLLER STATION

A. Touchscreen Control Stations to be Unison Echo EchoTouch Controller Mk2 by ETC, Inc. Controls 512 DMX addresses on up to 80 control zones.
   1. Standards Compliance: cULus Listed and CE Compliant. FCC Compliant.
   2. Operation: Graphic buttons, faders, and images on at least 7 user programmable default and fully graphical control pages.
   3. Touchscreen: Integrated with ETC Unison Echo Controls.
      a. Seven-inch, backlit liquid crystal display. Resolution: 800 by 400 pixels minimum, with capacitive multi-touch interface.
      b. Bezels: Cast aluminum. Finish: Fine texture powder coat.
         1) Four colors: Cream, Gray, Black, or Signal White.
         2) No visible means of attachment.
      c. Supports Surface, Flush and Rack Mounting.
         1) Flush-mount: To industry standard 3 gang back box.
         2) Surface Back Box Dimensions (WxHxD): 7.35 x 4.88 x 3.5 inches 187 x 124 x 3.5 89 mm) available from Manufacturer.
         3) Rack Mounting: Fit in standard 19 inch (483 mm) racks, no taller than 3 EIA rack units.
   4. Electrical:
      a. RJ45 Ethernet Port: Connection to lighting system and Power over Ethernet.
      b. Control Wiring: EchoConnect Connection terminals.
         1) Low-voltage, Class II unshielded twisted pair, type Belden 8471 and one No. 14 ESD drain wire; when not installed in grounded metal conduit.
         2) Topology free. Point-to-point, bus, loop, home run or any combination.
      c. Power Input, Non-PoE: Two, No. 16 AWG stranded wires for 24 VDC.
      d. Typical Power Draw: 400 mA.
      e. Firmware Maintenance: USB type A connector.
      f. Network:
         1) Network Cabling: Category 5 or better. Conform to TIA-568A/B. Installed by qualified network installers.
      g. Functional System:
         1) Presets: 64. Contained in non-volatile electronic memory.
         2) Internal sequences: 4. Record user-selected zone levels.
         3) Touchscreen: Equipped with on-board help system.
         4) Software upgrades: Via USB drive only.
         5) USB Port: Show data to be saved for archival or transfer to other consoles or a personal computer.
      h. Patching: Facilities for dimmers and multi-parameter devices via built in library of fixture definitions.
         1) Fixture Library: Updated via software based updates. Create custom fixture definitions using offline application.
         2) Touchscreen: Support patching, address setting, and mode changes using Remote Device Management (RDM) on local DMX/RDM port.
      i. Playback Control: Customizable zone display. Rearrange graphical representations for control channels to mimic fixture positions in installation.
         1) Seven user customizable interactive pages.
         2) Color and white pickers.
         3) Touch-based parameter controls with reference-based palettes.
         4) Virtual level wheel.
      j. Layout and Configuration: View and modify layout of user pages.
         1) Add, remove, or edit the following items: Preset buttons. Off buttons. Sequence buttons. Zone and space modifier buttons. Space combine buttons. Zone fader.

2) Three Options for Inactivity: Dim screen to level. Turn screen off. Display user chosen inactivity image.
3) Multiple Configurations: May be stored within an LCD Station.

5. Time Clock: Touchscreen built-in astronomical and real time event engine allowing presets and sequences activation.
   a. Support 80 Events: Astronomical, real-time, and manual control events in 16 control spaces.
   b. Timed Events: Programmable via Touchscreen.
      1) Assigned to day types.
         a) Day Types: everyday, weekday, weekend, and day of week.
      2) Activation: Based on sunrise, sunset, time of day, opened and closed events and configurable state based engine.
      3) Compensate for regions using daylight saving time.
      4) Assignment to events via time clock user interface.
      5) Resumes automatically after power loss.
   c. Support timed event hold. Timed Event Hold: Meet CA Title 24 requirements.
6. External Control: Control of lighting system through built-in UDP integration.
   a. Supports full control of lighting system using UDP strings.
      1) Security settings to limit incoming control strings to subscribers-only.
   b. Supports up to two subscribers for receiving status messages.
   c. Control and status integrations from 3rd party systems include:
      1) Zones.
      2) Channels.
      3) Presets.
      4) Spaces.
      5) Sequences.
      6) Lockout.

2.3 ECHO BLUETOOH INTERFACE

B. Interfaces:
1. Product: Unison Echo EchoAccess Interface.
   a. Model: EACC EchoAccess Interface.
   b. Communication from EchoAccess mobile app to devices on EchoConnect system bus via Bluetooth Smart.
   c. Mobile app available for Android and iOS.
   d. Preset, zone and color control for Echo products.
   e. Advanced feature configuration of Echo products.
2. Standards Compliance: UL and cUL Listed. CE Compliant.
   a. California Title 24 compliant.
3. Functional: Unison Echo EchoAccess Interface.
   a. Remote control of preset activation/deactivation, record, raise, lower, zone on/off control and room combine.
   b. Control of Zone Intensity, Color, Tint, and Color Temperature.
   c. Configuration of all Echo Control and Output Products.
   d. Configurable security levels for both connection and configuration.
4. Mechanical:
   a. Flush-mount in industry standard backbox, RACO 690 or equivalent Constructed of injection-molded, ABS plastic.
   b. Enclosed electronics assembly and faceplate included.
   c. Power and Bluetooth activity indicators.
      1) Blue power status indicator.
      2) Amber Bluetooth activity indicator.
5. Electrical:
   a. MicroSD card slot for firmware maintenance.
   b. Connects to two-wire EchoConnect control networks through low-voltage Class

2 wiring.
1) Topology-Free Wiring: Belden 8471 and No. 14 ESD drain wire.
2) Two No. 16 AWG wires for 24 VDC auxiliary power when required.

6. Operational Room Temperature: 32 to 122 degrees F (0 to 50 degrees C).
7. Relative Humidity Non-Condensing: 5 to 95 percent.

2.5 FIXTURE-MOUNTING TRACK SYSTEM

A. Track System
1. The track system shall be ONETrack and ONETrack Backbone as supplied by ETC, Inc.
2. Track system shall provide two 20-amp circuits with discrete neutrals and a Data bus that supports DMX, 0-10v, or DALI control
3. System shall allow for both end- and mid-feed options
4. A variety of couplers shall be available including:
   a. I-Coupler
   b. T-Coupler
   c. X-Coupler
   d. Flex-Coupler
5. Track with Backbone shall be capable of being suspension mounted
6. System shall allow for up to 22 lbs. per foot when track is properly supported

B. Mechanical
1. Track shall be constructed out of extruded aluminum measuring 1-7/16” x 1-¼” (37mm x 32mm).
2. Backbone shall be constructed out of extruded 6061 T6 aluminum measuring 3-1/4” x 1-3/4” (83mm x 44mm).
3. Track segments shall be available in 4’, 8’ and 12’ lengths.
4. System shall include rigid Backbone mounting option to support the following:
   a. OneTrack shall mount into Backbone on 8” centers
   b. Backbone shall support suspension mounting up to 10’ on center
   c. Backbone shall support up to 100lb point loads
   d. Backbone shall support up to 150lbs per foot when supported every 2’
   e. Backbone shall support mounting of non-track-mounted fixtures
5. Track and Backbone length shall be adjustable on site with a single cut.
6. Track shall have pre-punched holes for surface mounting.
7. Backbone shall support standard Unistrut mounting hardware for installation
8. Track and Backbone shall be available in black, white and silver.
9. OneTrack Fixture adapters shall support up to 11 lbs. on standard OneTrack or 22 lbs. when used on Backbone with a retaining collar.
10. Fixture adapters shall be made of a polycarbonate material.
    a. Available in black, white and silver
11. A variety of Backbone accessories shall be available including:
    a. Coupler Housings
    b. Coupler Housings with Pull Boxes
    c. Fixture Hangers
    d. Fixture Pigtail Adapters
       1) Fixture Pigtail Adapters shall include a cable terminated to an XLR connector for DMX data transmission and a powerCON or TrueOne connector for supplying power.
       2) Track adapters fitted with general-purpose receptacles that violate NEC requirements shall not be accepted.

2.6 DMX/RDM ETHERNET GATEWAY

A. General
1. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of lighting systems and transport of RDM configuration and status messages. The gateway shall permit DMX-512 data to be encoded, routed over an Ethernet network and decoded back to DMX-512. The unit shall be a Response DMX/RDM 4-port Gateway as provided by ETC, Inc.
2. Gateways shall communicate over Ethernet directly with lighting control products and other Ethernet interfaces.
3. Connections shall be made between gateways, consoles, architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.
4. The gateway shall support multiple protocols including:
   a. ANSI E1.17 Architecture for Control Networks (ACN)
   b. ANSI E1.31 Streaming ACN (sACN)
   c. ANSI E1.11 USITT DMX512-A
   d. ANSI E1.20 Remote Device Management (RDM)
5. The gateway shall be tested to UL standards and labeled ETL Listed.
6. The gateway shall be RoHS Compliant (lead-free).
7. The gateway shall be CE compliant.
8. The gateway shall have a backlit graphic LCD display for identification (soft-labeling) and status reporting.
9. Labeling shall be user configurable using ANSI E1.17 Architecture for Control Network (ACN), or a purpose-built software configuration tool.
10. The LCD display shall show DMX port configuration indication as well as indicate the presence of valid signal.
11. Gateways that do not indicate port configuration (input/output) and valid data shall not be acceptable.
12. Each gateway shall have power and network activity LEDs on the front of the gateway.

B. DMX Ports
1. DMX Ports shall comply with the requirements of ANSI E1.11 USITT DMX512-A standards.
2. Each DMX port shall be software-configurable for either input or output functionality.
3. DMX input shall be optically-isolated from the gateway electronics.
4. DMX output shall be earth-ground referenced.
5. DMX Port shall be capable of withstanding fault voltages of up to 250vAC without damage.
6. Each port shall incorporate one DMX512-A Connection.
7. Network gateways that do not indicate input/ output port configuration or presence of valid data shall not be accepted.

C. Processor
1. Each gateway shall have sufficient processing power to manage up to 63,999 universes (32,767,488 addresses).
2. Maximum delay time from input to output shall not be greater than one packet time (approximately 22 ms.).
3. A minimum DMX update rate of 40Hz shall be sustained under all conditions unless specifically configured for a slower rate for the sake of compatibility with 3rd party DMX devices.

D. Mechanical
1. The DIN Rail mounted gateway shall be included in an extruded aluminum enclosure.
2. Two wiring connections shall be required for connection to the lighting system

3. Ethernet connection that supports standard Cat5 patch cables.
4. DMX input or output connection using is terminal strip style connector.
5. Dimensions shall not be more than 8.03” wide (204mm) x 4.13” (105mm) deep x 1.22” (31mm) high (not including mounting hardware).

E. Power
1. Power for the gateway shall be provided over the Category 5 (or better) cable, utilizing IEEE 802.3af compliant Power over Ethernet (PoE). Power consumption using shall not be greater than 5 watts.
2. An optional low-voltage DC power input shall be available utilizing an isolated in-line power supply capable of an operating range of 8-28vDC. The Power supply shall be provided by the gateway manufacturer.
3. The gateway electronics shall be electrically isolated from the power supplied over the Catagory5e (or better) cable.

F. Configuration
1. Each gateway on the network shall be individually configurable using freely available software configuration tools. The primary configuration tool shall be Net3 Concert configuration software running on a network connected PC. The PC shall only be required for configuration and shall not be required for normal operation of the system.
2. Each DMX gateway shall control up to 512 DMX addresses, within the confines of 63,999 universes.
3. The specific DMX data input or output by the gateway shall be freely configurable by the user.
4. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.
5. Multiple DMX universes may be configured with any length up to 512 total addresses. Any range of DMX input addresses shall support selection and routing to the specified sACN output.
6. Multiple sACN sources may be combined with a priority may be assigned to each source sending data to the gateway.
7. All relevant routing information shall be stored in non-volatile memory at each gateway. The system shall recover from a power outage without requiring the PC to be online. Gateways that do not support non-volatile storage of data routing shall not be accepted.

G. Network
1. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications.
2. All network cabling shall be Category 5e (or better), conforming to TIA-568A/B, and shall be installed by a qualified network installer.
3. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.
4. ANSI E1.17 Architecture for Control Networks (ACN) and streaming ACN (sACN) shall be supported. Gateways that do not support ANSI E1.17 shall not be acceptable.
5. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.
6. Multiple DMX signal routing patches and multiple facilities shall be supported and limited only by the file storage capacity of the computer with ETC Gateway Configuration Editor (GCE) Software installed.
7. Each DMX gateway shall control up to 512 DMX addresses, per DMX port within the confines of up to 64,399 universes (32,767,488 addresses) using Streaming ACN (sACN).
    a. Any range of DMX addresses may be selected for each universe.

b. Multiple sources shall be supported by prioritized Highest Takes Precedence (HTP with priority). Each source shall support assignment of priority to allow override of default HTP behavior.
c. Each DMX port shall support its own universe and start address.

8. Gateways shall have built in DMX merger capability on a universe or channel-by-channel basis.
9. Gateways shall support have built in priority on a per-universe or channel-by-channel basis. Gateways that do not support prioritized merging of multiple network sources at independent priorities shall not be accepted.

H. Environmental
1. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).
2. The storage temperature shall be -40° to 70°C (-40° to 158°F).
3. The operating humidity shall be 5% - 95% non-condensing.

I. Accessories
1. ETC Net3 Concert Configuration and monitoring Software

J. System Requirements
1. Provide the quantity and type of gateways required, as scheduled.
2. Provide Ethernet switches and power supplies as scheduled and as shown on drawings.
3. Systems that do not provide the above capabilities shall not be acceptable

2.7 DMX REPEATER

A. Opto-Splitter Series:
1. Product: Response Opto-Splitter by ETC Inc. Provides quality and reliable DMX data distribution using industry-standard DMX and RDM.
a. Model: RSN-OPTO-8DIN. 8 Port DIN rail - Terminal.
b. Standards Compliance: cETLus Listed, CE compliant, EAC certified, RoHS compliant, WEEE.
c. Functional:
1) No configuration required.
2) Supports DMX512, DMX512 (1990), DMX512-A, ANSI E1.20 Remote Device Management (RDM).
3) Supports 256 total RDM devices
d. Mechanical:
1) DIN rail form factor:
a) Molded plastic enclosure.
b) Mounting complies with DIN43880 (35/7.5 rail).
c) Unit is 9 DIN units wide.
d) DIN installation enclosure available.
2) Power and data activity LED indicators.
a) Blue power indicator.
b) Green DMX activity indicator.
e. Environmental:
1) Ambient operating temperature: 32 to 104 degrees F.
2) Operating Humidity: 5 - 95 percent non-condensing.
3) Storage temperature: Minus 40 to 158 degrees F.
f. Electrical:
1) Supports DMX input and DMX thru.
2) Provides optically isolated DMX/RDM outputs.
3) DIN rail form factor:
a) Power Input: 12-48 VDC power input.

b) Power Draw: 8 W max
c) Wiring connections use pluggable rising clamp terminals.
4) IDC termination kits available.

2.8 FRONT OF HOUSE SPOTLIGHT LED ENTERTAINMENT LUMINAIRES (COLORSOURCE)

A. Basis of Design: ColorSource Spot Jr. as manufactured by ETC Inc. Compact four-color light engine. A mix of red, green, blue, and lime LED emitters. Original and Deep Blue arrays. Built-in zoom capabilities. 5,708 lumen output.
1. Standards Compliance:
a. Listed: cETLus, UL 1598, CSA C22.2 No. 250.
b. Compliance: CE and EAC.
2. Model ColorSource Spot jr XLR, black.
3. Model ColorSource Spot jr XLR, white.
4. Model ColorSource Spot jr Deep Blue XLR, black.
5. Model ColorSource Spot jr Deep Blue XLR, white.
6. Source:
a. LED Details: 52 Lumileds LUXEON C LEDs.
b. Max Lumens: Standard: 5,708. Deep Blue: 5,426. Lumens per Watt: 44.8.
c. L70 Rating: 54000 hours.
7. Color:
a. Colors Standard: Red, green, blue, lime
b. Colors Deep Blue: Red, green, indigo, lime.
c. Color Temperature Range: Color mixing.
d. Calibrated Array: Yes.
e. Red Shift: No.
8. Optical:
a. Beam Angle Range: 25 to 50 degrees. Swappable lens tubes.
b. Gate Size: 1.96 inches.
c. Aperture Size: 6.25 to 14 inches.
d. Pattern Projection: Yes.
e. Pattern Size: M. OD: 2.6 inch, ID: 1.89 inches, up to 0.080 inches thick.
f. Camera Flicker Control / Hz Range: Default: 1,200 Hz. RDM: 25,000 Hz.
9. Control:
a. Input Method: DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM.
b. RDM Configuration: Yes.
c. User Interface Type: 7-segment 3 button interface.
d. Local Control: Yes.
e. Onboard Presets: Yes, 12. Onboard sequences: Yes. 5. Onboard effects: No.
f. Fixture-to-Fixture Control: Yes.
g. 15-bit virtual dimming engine.
10. Electrical:
a. Voltage: 100 to 240 VAC, 50 to 60 Hz. Input Method: PowerCON in and thru.
b. Inrush, First Half Cycle: 35 A at 120 V. 45 A at 240 V.
c. Fixtures per Circuit:
1) Seven: 15 A power thru connector.
2) Eight: R20 module or similar.
d. Wattage (Typical / Standby): 166 W / 2.6 W at 120 V. 162 W / 2.0 W at 240 V.
e. Current Draw: 1.40 A at 120 V. 0.73 A at 240 V.
11. Thermal: Operating Temperature: 32 to 104 degrees F.
a. Fan: Yes. Not controllable. db Range: 202 dBA average at 39 inches.
b. Droop Compensation: Yes.
c. BTUs/hour: 549.
12. Physical: IP Rating: IP-20.

a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
b. Mounting: Yoke.
Accessories: Hanging yoke, 5 ft power cable

2.9 OVERSTAGE WASH LED ENTERTAINMENT LUMINAIRES (DESIRE SERIES)

A. Basis of Design: Desire D22 as manufactured by ETC Inc. A color-mixing high-intensity LED illuminator with DMX control of intensity and color. Puts x7 Color System into a compact, round washlight. Die-cast enclosure, noiseless fan-free operation, multiple lens options, convenient size, and advanced user interface.
1. Standards Compliance:
a. Listed: UL 1573 and CSA C22.2 No. 166.
b. Compliance: CE and EAC.
2. Model Lustr+: Optimized array with six colors plus high-intensity white LEDs to create an ideal wash fixture for full-range color.
3. Model Studio Daylight: Contains twenty-two 5600 K LEDs for high-intensity, non-variable cool-white output.
4. Model Studio Tungsten: Contains twenty-two 3000 K LEDs for high-intensity, non-variable warm-white output.
5. Model Studio HD: Combines warm white and cool white LEDs for variable-color-temperature mixing. Added to this are carefully chosen colors from the Selador x7 Color System to fill in the white LED spectral gaps, providing the richest variable-white light possible in an LED fixture.
6. Mounting: Portable. Standard yoke-mount hardware; power lead with Edison / Schuko / UK13A connector and DMX in / thru connectors
7. Mounting: Install Canopy: Standard yoke-mount and canopy hardware; power lead with bare ends; and a permanent, single DMX in / thru cable
8. Mounting: Track-Yoke: Track adapter and a single, permanent cable for both power and DMX in.
9. Source:
a. LED Details: 22 Lumileds LUXEON Rebel LED.
b. Lustr+: Max Lumens: 1,499. Lustr+: Lumens per Watt: 31.
c. Studio Daylight: Max Lumens: 2,533. Lumens per Watt: 50.
d. Studio Tungsten: Max Lumens: 2,096. Lumens per Watt: 41.
e. Studio HD: Max Lumens: 1,247. Lumens per Watt: 31.
f. L70 rating: 50,000 hours.
10. Color:
a. Colors Lustr+: Red, Amber, Green, Cyan, Blue, Indigo, White
b. Colors Studio HD: Red, Amber, Green/Cyan, Blue, Warm White, Cool White
c. Colors Studio Daylight: White
d. Colors Studio Tungsten: White
e. Color Temperature Range: 2,700 to 6,500 K
f. Calibrated Array: Lustr+: Yes
g. Calibrated Array: Studio Daylight: No
h. Calibrated Array: Studio Tungsten: No
i. Calibrated Array: Studio HD: Yes
j. Red Shift: Yes (Lustr+ and Studio HD)
11. Optical:
a. Beam Angle: 8 to 71 degrees.
b. Aperture Size: 6 inches
c. Pattern Projection: No.
d. Camera Flicker Control / Hz Range: Yes. 900 to 25,000 Hz.
e. Secondary lenses for multiple beam-spread options.
12. Control:
a. Input Method: DMX512 via 5-pin XLR (portable only) Permanent power input

cable. Protocols: DMX-512/RDM
b. RDM Configuration: Yes.
c. User Interface Type: LCD.
d. Local Control: Yes.
e. Onboard presets: Yes. Onboard sequences: Yes. Onboard effects: No.
f. Fixture-to-fixture control: Yes.
g. 15-bit virtual dimming engine.

13. Electrical:
    a. Voltage Range: 100 - 240 VAC 50/60 Hz.
    b. Input Method: Requires power from a non-dimmable source.
    c. Portable: Edison, Schuko or UK13A connector.
    d. Inrush First Half-Cycle: 17 A at 120 V. 25 A at 240 V.
    e. Fixtures per Circuit: 20 (R20 module or similar).
    f. Wattage: 56.5
    g. Current Draw: 0 A at 110 V. 0.48 A at 120 V. 0 A at 230 V. 0.288 A at 240 V.
14. Thermal: Operating Temperature: 32 to 104 degrees F.
    a. Fan: No. db Range: N/A.
    b. Droop Compensation: Yes.
    c. BTUs/hour: 192.778.
15. Physical: IP Rating: IP20 for portable and canopy versions. IP40 for track version.
    a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
    b. Hanging yoke.
16. Secondary Lens Options:
    a. Narrow Linear Field: Lenses may be combined to create desired field size.
        1) Narrow, Medium, Wide, and Extra wide lens.
    b. Round Field: Narrow, Medium, Wide, and Extra wide lens.
    c. Oblong Field: Narrow, Medium, and Wide lens.
    d. an A-size gobo holder.

2.10 PROVIDE THE FOLLOWING: FOH ***WHITE FINISH***

1	ETC Foundry 4 relay panel
1	ETC Echo Touchscreen with locking cover
1	ETC Echo access station for Bluetooth lighting control
1	ETC DIN14 – Wall Mount Box
1	ETC E-SPS-DIN – ECHO STATION Power Supply
1	ETC Response Optosplitter Din Rail Mounted
2	ETC 8-foot Onetrack with Backbone lighting positions, complete with live end feeds, fixture hanging adaptors, pigtail adaptors, DMX terminators, white finish
2	ETC 8-foot Onetrack, complete with live end feeds, DMX terminators, black finish
8	ETC Colorsource Jr Spot Zoom Fixtures with track fixture hanging adaptors, safety cables, track pigtails, white finish
8	ETC Desire D22 Lustr+ Fixtures, track mounted, with safety cables and WFL Lenses, black finish
Lot	Any other equipment or incidental items, even if not specifically mentioned, if necessary, for a complete and working system shall be included by the contractor at no extra cost to the Owner.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of this equipment shall only be performed by manufacture approved and factory trained theatrical rigging installers. Installation shall be performed in a workmanlike manner and shall strictly adhere to the standards of these specifications and manufacture's

installation requirements. Where necessary, the installer may make adjustments to accommodate unforeseen impediments to installation. The completed work must achieve all electrical, safety and appearance requirements as established in these specifications. Install all new equipment in compliance with national and local electrical codes. Auxiliary equipment required to make this installation comply with codes, even if not listed in the specification, is the responsibility of the contractor.

B. All wiring shall be done in a craftsman-like manner. When conductors must be spliced to extend length, it shall be done with a terminal strip or suitable type compression fittings.

C. Equipment shall be kept clear of all metal shavings, wire scraps, and miscellaneous trash. Any abandoned holes in the floor shall be patched.

D. Any existing conduit emanating from the floor shall be dressed in such a manner as to eliminate any trip hazard. Conduits shall be re-routed or terminated into wire-ways to insure a neat installation.

E. All equipment shall be installed in compliance with applicable local and national codes. It shall also be installed in accordance with the manufacturer's recommendations. Prior to initial energizing, a factory certified technician shall inspect the system and any errors shall be corrected.

F. Pipes positions shall be rigidly fixed, and conduit shall be flexible, following the hanging points. Conduit shall not obstruct the pipe: it shall be possible to add additional portable fixtures anywhere on the pipe position without obstruction.

G. Provide all lighting fixtures and accessories as indicated or required. All portable fixtures shall be unboxed, lamped, hung on pipe positions, tested, and focused for an even stage wash. Safety cables shall be installed around fixture yoke and pipe position. Data cables shall be installed to connect all fixtures to DMX as needed, with excess cable tied neatly to pipe.

H. Portable lighting console and cables shall be tested and provided for the system Energization and training and then turned over to the owner.

I. Work shall be performed in accordance with OSHA and local codes.

J. On site welding shall only be performed per AWS D1.1 standards and with advanced approval from the architect or Owner’s representative.

3.2 COMMISSIONING

A. Operational Tests: Energize lighting controls systems, program controls, and check controlled outlets for light levels. Program test scenes so every fixture is tested throughout its operating range. Check programmed function at each control station. Adjust components and revise installation to correct deficiencies.

B. Correct deficiencies and retest deficient items. Verify by the system tests that specified requirements are met.

END OF SECTION 26 55 61

SECTION 26 56 00 SITE LIGHTING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The extent of site lighting required is indicated on the drawings and schedules and by the requirements of this Section and Section 26 05 00 General Electrical Provisions.

B. Poles and Standards specified in this Section are for outdoor use for the support of luminaires and include the following: Aluminum and/or steel

1.2 QUALITY ASSURANCE

A. Codes and Standards: Provide luminaires, poles standards and appurtenances conforming to the following:
   1. Conform to applicable sections of American Association of State Highway and Transportation Officials (AASHTO): LTS-1 Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.
   2. American National Standards Institute (ANSI):
      a. C2 National Electrical Safety Code.
   3. Conform to applicable sections of American Society for Testing and Materials (ASTM)B 429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
   4. National Electrical Manufacturers Association (NEMA):
      a. FA 1 Outdoor Floodlighting Equipment.
      b. OD 3 Physical and Electrical Interchangeability of Photo Control Devices and Mating Receptacles.
   5. Conform to applicable sections of National Fire Protection Association (NFPA) 70, National Electrical Code.
   6. Underwriters Laboratories, Inc. (UL):
   7. Design Lights Consortium (DLC)

1.3 SUBMITTALS

A. Refer to Section 26 05 00 General Electrical Provisions. Submittal must include photometric reports, otherwise they will be rejected as incomplete.

B. Contractor shall not rough-in, build concrete foundations, etc. for site lighting until all site lighting submittals have been approved. Contractor shall submit site lighting photometrics with product data. The review of site lighting submittals may include the relocation, addition or deletion of lighting fixtures, poles and standards due to the photometric performance of substituted manufacturers. Any changes required due to the contractor's substitution shall be at no cost to the Owner.

C. Submittal sheets shall be sequentially numbered with the format: Sheet number of number total. Example 1 of 3

D. Submit manufacturer's product data including the following:
   1. Line-by-line compliance of the specification indicating compliance or description of deviation.
   2. Submit a computer generated point-by-point calculations for all outside lighting.
   3. Dimensioned and detailed drawings in booklet form with separate sheet or sheets for each fixture, assembled in luminaire "type" alphabetical order and

showing: materials of construction; arrangement of components and wiring; gasketing for weather tightness; means of mounting luminaire and adjusting aspect; finishes; photometric data with lamp or lamps specified; electrical data including volts, amperes and watts; and for roadway type luminaires, distribution data according to Illuminating Engineering Society (IES) roadway classification type.

4. LED Driver and light engine, initial and mean lumen output, and color rendering index. LED drivers and related electrical characteristics and operating conditions.
5. Poles and standards dimensions, details of hand holes and wire entries, mast or bracket arms and connection to poles, wind load and deflection, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers acceptable contingent upon Product's compliance with the specifications: refer to Lighting Fixture Schedules on the drawings for acceptable manufacturers of light fixtures. Acceptable Pole Manufacturers: Valmont, KW, WJM.

B. Where lighting regulations exist by the Authority Having Jurisdiction, the Contractor shall be responsible for submission of all documentation and approval from the Authority Having Jurisdiction of the exterior lighting were alternate manufacturers are proposed other than specified. Where approval from an Authority Having Jurisdiction is required, Contractor shall submit, with those product data, confirmation of approval from the Authority Having Jurisdiction.

2.2 LUMINAIRES

A. Refer to Section 26 51 13 Lighting Fixtures and Lamps, for ballast, drivers, and lamp requirements.

B. Provide luminaires of the sizes, type and ratings indicated, complete with housings, lenses, refractors, lamps, lamp holders, reflectors, ballasts, starters, igniters, mounting brackets or hardware with adjusting means and wiring.

C. Provide luminaires with rigidly formed, weather and light tight enclosures that will not warp, sag, or deform in use. Provide housings free from burrs, sharp edges or corners.

D. Provide captive hardware hinged doors, operating freely, to allow lamp installation and removal without the use of tools. Equip door mechanism to preclude accidental falling of the door when opening or closing or when secured in the closed position. Provide for door removal for cleaning or replacing lens.

E. Provide stainless steel hinges, latches, fasteners, and hardware to prevent corrosion of hardware or the staining of adjacent surfaces.

F. Use interior formed and supported light reflecting surfaces having reflectances of not less than 85 percent for white surfaces, 85 percent for specular surfaces, and 75 percent for specular diffuse surfaces.

G. Use borosilicate tempered glass, lenses and refractors. Use heat and aging resistant resilient gaskets to seal and cushion lens and refractor mounting in luminaire doors.

H. Provide finishes of the color and type indicated and having the following properties:
1. Protection of metal from corrosion - 5 year warranty against perforation or

erosion of the finish from weathering.

2. Color retention – 5-year warranty against fading, staining, or chalking from weathering, including solar radiation.
3. Provide finish of uniform thickness and color, free from streaks, stains or orange peel texture.

I. LED sources shall meet the following requirements:
1. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
2. Color Rendering Index (CRI): ≥ 65.
3. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).

J. LED drivers shall meet the following requirements:
1. Drivers shall have a minimum efficiency of 85%.
2. Starting Temperature: -40˚ F.
3. Input Voltage: 120 to 480 (±10%) V.
4. Power Supplies: Class I or II output.
5. Surge Protection: The system must survive 250 repetitive strikes of “C Low” (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. “C Low” waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
6. Power Factor (PF): ≥ 0.90.
7. Total Harmonic Distortion (THD): ≤ 20%.
8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.3 POLES AND STANDARDS

A. Provide poles of the types and heights indicated. Provide internal raceway for underground power supply, with luminaire support pole base indicated. Provide poles that will carry the indicated supports, luminaires and appurtenances, at the required heights above grade, without excessive defection or whipping of the luminaire when subjected to 120 mph basic wind speed with 1.3 gust factor. Pole structural integrity shall rely solely on the anchor bolts, nuts and washers. Pole shall not be in direct contact with concrete base or mortar.

B. Provide metal lighting poles with steel or aluminum shaft; equipped for post top or mast arm luminaire mounting. Provide wiring access hand hole with welded ½” NC ground lug, readily accessible from hand hole opening. Provide features as follows:
1. Provide a one-piece pole shaft fabricated from a weldable grade carbon structural steel tubing with a uniform thickness as required. Material shall conform to ASTM A-500, Grade C.
2. Provide anchor base of the same material and finish as the pole, welded to the pole. Provide adequately sized (at least 15 square inches) hand hole with screwed cover. Provide galvanized steel hold-down or anchor bolts and leveling nuts. Provide full base cover.
3. Factory prime coat with polyester powder-coat paint. Steel poles shall be hot dipped galvanized, with prime coat, with 8 mil minimum polyester powder-coat paint. Color to match light fixture.

C. Anchor bolts:
   1. Provide zinc coated anchor bolts and nuts. Length shall be per pole manufacturer's shop drawings, complete with 3 inch right angle bend on one end and 6 inches of thread on the other end. Provide zinc coated flat washers, lock washers, and hexagonal nuts for each pole.
   2. Provide template for positioning of anchor bolts.

D. Accessories:
   1. Full base covers, finish to match pole
   2. Hand hole with cover plate and vandal resistant hardware.

2.4 LUMINAIRE MOUNTING

A. Provide corrosion resistant metal luminaire mounting compatible with the poles and fixtures that will not cause galvanic action at contact points. Provide mounting that will correctly position the luminaire to provide the required light distribution. Provide drill mounting to pole shaft unless specified otherwise.

B. Provide brackets, cantilevered and without under brace, of the sizes, styles, and finishes indicated with straight tubular end section to accommodate the luminaire.

C. Provide steel tenon only for single fixture yoke or spider post top mounting securely fastened to the top of the pole shaft, fabricated to accept and rigidly support the luminaire to be mounted thereon. Set screws shall have pole shaft drilled to prevent rotational movement.

PART 3 - EXECUTION

3.1 LIGHTING POLE INSTALLATION

A. Contractor shall not rough-in conduit, drill or pour concrete foundations for site lighting until review of the site lighting submittals is complete. This is to ensure coordination with the current site plan paving and utilities and photometric performance of the submitted product.

B. Install lighting poles as follows:
   1. Install lighting poles and standards as indicated, in accordance with manufacturer's written instructions, and in compliance with ANSI C2.
   2. Provide excavation and poured concrete bases using 3,000 pound 28-day concrete, and provide anchor hook-bolts, nuts and washers in conformance with the details and manufacturer's requirements. Refer to Division 3 for concrete work. Project anchor bolts 2-inches minimum above base. Use double nuts for adjustment.
   3. To protect finish, use fabric web slings (not chain or cable) to raise and set finished poles and standards.
   4. Install pole clear of contact of concrete base or mortar.

C. Grounding: Provide equipment bonding and grounding connections, sufficiently tight to assure permanent and effective grounds. Bond all metal, non-current carrying parts to ground. Provide 25-feet #4 solid ground electrode from pole base hand holes encased in concrete pier, to bottom of concrete pier with excess ground electrode coiled at bottom of concrete pier. Secure the ground electrode to the reinforcement steel to prevent movement during concrete pour. Bond all metal parts of the pole shaft ground lug. Provide #6 electrode grounding conductor from pole base ground lug to the ground conductor, using thermal fusion (exothermic) methods.

D. Wiring:

1. Provide Type SO cord from base of pole lights to top of poles. Do not use single conductors.
2. Install inline fuse holders, fuses, at base of pole lights on each lighting circuit. Provide Bussman Insulating boot Catalog # 2A0660 installed over conductor terminations. Fuse size shall be as follows:

WATTAGE	# OF Fixtures	208V	240V	277V	480V
0-400	1	5	5	5	5
0-400	2	8	8	5	5
0-400	3	10	10	8	5
0-400	4	15	10	10	8
401-1000	1	10	8	8	5
401-1000	2	15	15	15	8

3. Provide Styrofoam wedge at midpoint of pole to stabilize conductor.
4. Provide strain/stress relief on SO cord at top of pole.

3.2 LUMINAIRE INSTALLATION

A. Install exterior luminaires at locations and heights as indicated, in accordance with the manufacturer's written instructions, applicable requirements of NFPA 70, ANSI C2 and with recognized industry practices to ensure that lighting installation fulfills requirements.

B. Fasten luminaires securely to indicated structural supports and check to ensure that the required degree of freedom is provided to allow alignment or aiming of the fixtures for indicated light distribution.

C. Clean exterior luminaires of dirt and debris upon completion of installation. Do not damage finishes or lens or refractor surfaces.

D. Provide equipment grounding connections using branch circuit equipment and connected sufficiently tight to assure a permanent and effective ground.

3.3 TESTS AND DEMONSTRATIONS

A. Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. Correct malfunctioning units, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting. Verify correct reflector types and orientation prior to final aiming.

B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including reflectors, plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts. Pre-aim lighting fixtures as practical prior to final aiming and adjustment.

C. Final aiming and adjustment: Aim and adjust lighting fixtures for their intended purpose as specified or as required. Adjustments may include but not be limited to directional aiming, adjusting selectable lumen output, selectable correlative color temperature (CCT), selectable beam pattern, replacing/installing fixture manufacture's optional optical

lens used for adjusting beam patterns or for softening beam edges, replacing/installing manufacture's optional theatrical/specialty color lens colors. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

3.4 LAMP REPLACEMENT AND PROVISION OF ATTIC STOCK

A. At time of substantial completion, replace lamps in luminaires that are observed to be not functioning properly after Contractor's use and testing.

B. For each light fixture type, furnish two percent, a minimum of two to a maximum of 25 complete light fixture assemblies and a quantity of 50 individual component LED drivers and LED chip arrays.

END OF SECTION 26 56 00

SECTION 27 01 00 **OPERATION AND MAINTENANCE (O&M) MANUALS OF COMMUNICATIONS SYSTEMS**

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three (3) electronic copies, on separate devices (CD, USB Flash Drive, or some type of solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer’s operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.

D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.

E. Recorded video of all training sessions shall be included in each copy, of each system’s final submitted O&M.

F. The final submitted manual shall include a sing-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant’s stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System’s O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant’s stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of Speakers, Amplifiers, Sound Equipment, Etc.
12. Schedule of Handsets and other Peripheral Devices, Etc.
13. Schedule of Cable, Jacks, Outlets, Etc.
14. Access Control Door Schedules
15. Video Surveillance Camera Schedules
16. Other required operating and maintenance information that are complete.
17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
   1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
   2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.

D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.

F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Upon the request for hard copies of the O$M manuals, the binders shall consist of the following configuration:
   1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
   2. Minimum ring size: 1"; Maximum ring size: 3".
   3. When multiple binders are used, correlate the data into related groupings.
   4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals Submitted in Hard Copy Format:
   1. Prepare data in form of an instructional manual for use by Owner's personnel.
   2. Format:
      a. Size: 8-1/2" x 11"
      b. Text: Manufacturer's printed data or neatly typewritten.
   3. Drawings:
      a. Provide reinforced punched binder tab and bind in text.
      b. Fold larger drawings to size of text pages.
   4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
   5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
      a. Title of Project
      b. Identity of separate structures as applicable
      c. Identity of general subject matter covered in the manual.
   6. Binder as specified

B. Content of Manual:

1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer
      2) Maintenance contractor as appropriate
      3) Identify area of responsibility of each.
      4) Local source of supply for parts and replacement
   d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product.
   b. Annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:
      1) Relations of component parts of equipment and systems
      2) Control and flow diagrams
   b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
   c. Do not use Project Record Documents as maintenance drawings.
4. Written text as required to supplement product data for the particular installation:
   a. Organize in consistent format under separate headings for different procedures.
   b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure
      2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts:
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine / normal operating instructions
      2) Regulation, control, stopping, shut down and emergency instructions
      3) Special operating instructions
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting
      3) Disassembly, repair and reassembly
      4) Alignment, adjusting and checking
      5) Routine service based on operating hours

d. Manufacturer's printed operating and maintenance instructions.
e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
f. Complete equipment field accessible wiring diagrams
g. Each Contractor's coordination drawings
h. Other data as required under pertinent sections of the specifications

2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 27.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION 27 01 00

SECTION 27 05 00 **COMMUNICATIONS BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 27 Communications.

B. Applicable provisions of this section apply to all sections of Division 27, Communications.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
1. Division 26 in its entirety.
2. Division 27 in its entirety.
3. Division 28 in its entirety.

D. The entire drawing and specification package apply to the work specified in the communication specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with current and applicable Codes, Standards, Rules, Ordinances, Regulations, and Best Practices (both published and best practices) as well as any other authorities that may have lawful jurisdiction pertaining to the work specified. None of the terms or provisions of this specification shall be construed as waiving any of the rules, regulations, or requirements of these authorities (including those not specifically listed in this Specification). Applicable Codes and Standards shall consist of, but not be limited to the following:
1. Americans with Disabilities Act (ADA)
2. Authorities Having Jurisdiction (AHJ) - Local
3. American National Standards Institute (ANSI)
4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
5. Building Industry Consulting Services International (BICSI)
6. Code of Federal Regulations - Title 47
7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area*

Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series

13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
16. National Electrical Contractor's Association (NECA) *Standards of Installation*
17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards
22. Telecommunications Industries Association (TIA) *(ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*
23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

D. Obtain all permits required.

1.3 SUMMARY

A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.

B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.

C. Provide complete and working Communications Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The Communications Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All Communications Systems plans, and specifications are to be returned to the Architect following completion of bid.

1.4 CONTRACTOR'S QUALIFICATIONS

A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners

satisfactorily for not less than 3 years.

3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
   a. Licenses, as applicable to the system being installed
   b. Manufacturer's Certifications
      1) Firm Certification
      2) Installer Certification
      3) Programmer's Certification
      4) System Designer Certification.

1.5 DRAWINGS AND SPECIFICATIONS

A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.

B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.

C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated on drawings govern scale measurements and large-scale details govern small scale drawings.

D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.

E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.

F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.

G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.

H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.

I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.

J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.

B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.

C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.

D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.

E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.7 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously

study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3” beyond the finished surface. In pipe chases, they shall extend 8” inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio.1/2 inch greater than outside diameter of the conduit.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
1. Make final connections to all communications equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.8 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.9 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.10 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.11 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that

equipment performs within designated limits on a vibration chart.

1.12 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 27 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.

C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

1.13 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
1. Obtained from utility maps and other substantially reliable sources.
2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.14 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.15 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CATV	Cable Antenna Television
CCTV	Closed Circuit Television
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Gbps	Giga Bits Per Second

Hz	Hertz
IC	Intermediate Cross-connect
IDF	Intermediate Distribution Frame
IM	Information Management
IS	Information Systems or Information Services (also see MIS)
IT	Information Technology
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MATV	Master Antenna Television *(A.K.A. Main Antenna Television)*
Mbps	Mega Bits Per Second
MC	Main Cross-connect
MDF	Main Distribution Frame
MHz	Megahertz
MIS	Management Information Systems or Services
NEXT	Near-End Cross Talk
nm	Nanometer
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
PBX	Private Branch Exchange
POS	Point of Sale
PSELFEXT	Power Sum Equal Level Far-End Cross Talk
PSNEXT	Power Sum Near-End Cross Talk
SMATV	Satellite Main Antenna Television
TC	Telecommunications Closet *(Now referred to as TR)*
T.O.	Telecommunications Outlet
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Administration Subsystem - Cable, connectors, cross-connect and inter-connect hardware, patch cords, and other equipment that allows easy reconfiguration of the telecommunications system to accommodate personnel and floor plans changes.

Campus Backbone Subsystem - Connects telecommunications processing equipment in different buildings on the same campus.

Communications Cabling - Any fiber optic, copper, coaxial or other transmission media used for transmitting or receiving communications systems data.

Communications System - Communications Systems and associated wired or wireless interconnection.

Communications Drawings - All floor plans, elevations, details, schematics, block diagrams, legends, tables, notes or attachments associated with any or all of the Communications Systems.

Distribution Cable - The telecommunications UTP wiring between the telecommunications room and the outlet connectors.

Equipment Subsystem - Telecommunications cable, connectors, support hardware, blocks, and protective devices that serve to connect the network interface and the backbone subsystem through the administrative subsystem.

Horizontal Subsystem - Telecommunications cable, outlets and distribution cords that extend the riser backbone from the administrative points in the TRs to workstations.

Information Systems - Software systems including operating systems, programs, data manipulation and management systems, control software and various forms of proprietary and off-the-shelf software.

Information Technology - The practical application of knowledge associated with designing, installing and maintaining the equipment, hardware and infrastructure utilized for control, distribution, or display of telecommunications, audio, video and data signals. Because computers are central to information management, computer departments within companies and universities are often called (IT Departments) and are responsible for MIS or IS personnel and services.

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the Communications Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the Communications Systems operational or for system communications.

Management Information Systems - A class of software that provides managers with tools for organizing and evaluating their department. Typically, MIS systems are written in COBOL and run on mainframes or minicomputers. Within companies and large organizations, the department responsible for computer systems is sometime called the MIS department. Another name for MIS is Information Services (IS).

Multiplexer - A communications device that multiplexes (combines) several signals for transmission over a single medium. A multiplexer is sometimes called a "mux". A demultiplexer is required to complete the process by separating multiplexed signals from a transmission line. Frequently a multiplexer and demultiplexer are combined into a single device capable of processing both outgoing and incoming signals.

Riser Backbone Subsystem - Telecommunications cable, splice enclosures, and associated hardware that provide the main cable routes in a building. It interconnects building floors and larger areas of a single floor. It also interconnects administrative points in satellite TRs to the administrative points in the building main equipment room.

Station Cable - The wiring between the outlet connections and the work area equipment.

Communications Systems - One or more of the following and associated equipment: Data/Networking Systems, Telecommunications Systems, Paging / Intercom Systems, Clock/Control Systems, Master Antenna Television Systems, Cable Antenna Television Systems, Broadcast Video Systems, Audio/Visual Presentations Systems, Microwave/Wireless Systems.

Telecommunications - The transmission, emission or reception of signs, signals, images, sound or intelligence of any nature by wire, radio, optical or other technical transmission system.

Work Area - Location of an employee or student and their data/telecommunications equipment or devices.

Work Area Subsystem - Station mounting cords, extension cords, connectors, adapters, and interface units that provide physical and electrical connectivity between workstation equipment and the horizontal subsystem.

1.16 QUALITY ASSURANCE

A. Equipment Standards:
1. System and all components shall be brand new stock from manufacturer.
2. All electronics shall be 100% solid state.
3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
At the time of Proposal, the Contractor shall:
1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.17 SUBMITTALS

A. Provide SUBMITTALS according to Division 01 and the following.

B. Requirements:
1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
2. Submit proof that all system components and cables are U.L. Listed.
3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal component in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted but is

subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day’s notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The

Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.24 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.25 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and under-slab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014 or later / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. 3 sets of electronic AutoCAD (2014 dwg or later) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
3. Three sets of blue or black-line prints of each contract as-built drawing.

C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s Seal, name, address, and logo from drawings.
3. Mark documents AS-BUILT DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY:
5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
6. Indicate exact location of all underground communications raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all communications equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all communications equipment in and outside of the building.
11. Location, size and routing of all communications cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.26 OPERATING TESTS

A. After all communications systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.27 WARRANTY

A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.30 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.3 STANDARD PRODUCTS

A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

2.4 MANUFACTURE'S INSTRUCTIONS

A. The Contractor is responsible for furnishing the proper Communication equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

2.5 RUST PREVENTION

A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

2.6 STORAGE AT SITE

A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.

B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.

C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

2.7 CONDITION OF MATERIALS

A. All materials required for the installation of the Communication systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

2.8 NAMEPLATES

A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

2.9 ACCESS DOORS

A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
1. Plaster Surfaces: Milcor Style K.
2. Ceramic Tile Surfaces: Milcor Style M.
3. Drywall Surfaces: Milcor Style DW.
4. Install panels only in locations approved by the Architect.

2.10 SPACE LIMITATIONS

A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc. Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be

assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network, Telecommunications and Communications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. Ground busses shall be provided in each any room with communication equipment.

J. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

K. Communications grounding system shall be a single point grounding from the building entrance electrical ground to each Communications room.

L. All Conduit systems, cabinets' racks, cable trays, protector blocks, SCTP patch panels and/or miscellaneous equipment, etc. shall be grounded by being connected to the common communications grounding system. The conductors shall be a # 6awg solid with a green jacket

M. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

N. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

O. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.

P. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

Q. The installation shall be performed in a professional manner.

R. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

S. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

T. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

U. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If

screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). Communications cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Handwritten tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all Communications Systems wiring.

C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.

D. Identification of Equipment:
1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and communications (voice, data, video) cabinet or rack.
   a. Identifying nameplates shall have 1/2-inch high, engraved letters. For equipment designation and ¼-inch letters indicating source circuit designation, (ie: "IDF(FCR) XXYY –served from MDF (BCR) XXGG).
3. Permanent, waterproof, black markers shall be used to identify each communications grid junction box, clearly indicating the type of system available at that junction box.
4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.

5. Communication hardware located above accessible ceilings: Provide ½-inch high black name plate with white 1/4-inch letters glued to bottom of t-grid ceiling below hardware located above ceiling. Identification shall be as short as possible yet identifying device above ceiling, i.e. “A/V-EQ”.

E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of communications facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.

H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried communications lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline in triplicate, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.

B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the communications systems.
1. Provide the training during regular working day.
2. The Instructors shall be experienced in their phase of operation and maintenance of the systems and with the project.

C. Time to be allocated for instructions.
The Contractor shall furnish the services of factory trained specialists to instruct the Owner's operating personnel. The Owner's operator training shall include training as specified per system specification,
1. Minimum of four (4) hours dedicated instructor time
2. 2-hour sessions on different, non-consecutive days
3. Additional instruction time for specific systems as specified in other Sections.

D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

E. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.

F. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

G. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.

H. Demonstrate equipment functions (both individually and as part of the total integrated system).

I. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

J. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

K. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

L. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.8 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each communications location.

3.13 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.

B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.

C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be

performed by workmen skilled in the work ad in accordance with standard practice of the trades involved.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

3.15 EXISTING SYSTEM TESTING

A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 27 umbrellas, as identified in the Division 27 of the Construction Specifications Institute (CSI) current Master Format . Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.

B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.

C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.

D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

3.16 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all Communications Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect’s judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer’s factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should

include:

1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

B. All materials shall be neat, clean and unmarred, and parts securely attached.

C. All extra material as specified shall be delivered and stored at the premises as directed.

D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.18 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.

B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:

1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:

1. The Contractor shall perform all tests required by Division 26 and those submitted as part of this Section.
2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:

1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2)

sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
1. System Operations and Maintenance Manuals
2. System Test Reports
3. As-Built Drawings

3.19 FINAL ACCEPTANCE

A. The date of final acceptance shall be the date of owner occupancy, or the date all punch list items have been completed or final payment has been received. Refer to Division 1 for additional requirements

E. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION 27 05 00

SECTION 27 05 07 COMMUNICATIONS SHOP DRAWINGS, COORDINATION DRAWINGS AND PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 01 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

D. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each room containing technology equipment and each rack with technology equipment, submit plan and elevation drawings. Show:
1. Actual technology equipment and components to be furnished.
2. NEC working space and NEC access to NEC working space.
3. Relationship to other equipment and components and openings, doors and obstructions
4. Rack location and dimensions

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Verify location of communications station devices, telephone outlets and other work specified in this Division.
   1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
   2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such

submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name, address and telephone number
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
    a. Contractor
    b. Subcontractor
    c. Supplier
    d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
   1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
   2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
   1. The related specification section number
   2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals.
   1. Indicate that the document or sample is a resubmittal
   2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
   1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
   2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
   3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submit individually bound shop drawings and product data for the following when specified or provided:
   1. Structural Cabling
   2. Communications System
   3. Sound Reinforcement System
   4. CATV System

3.2 COORDINATION DRAWINGS

A. Submit coordination drawings as specified.

END OF SECTION 27 05 07

SECTION 27 05 09 CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
1. Field conditions.
2. Condition of installation.
3. Quality of workmanship.
4. Start-up of equipment.
5. Testing and adjusting of equipment.

B. Manufacturer’s qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
1. Rough-in
2. Finish with all appurtenances in place
3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer’s qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

A. Mock-up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. Provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION 27 05 09

SECTION 27 10 00 STRUCTURED CABLING SYSTEM (SCS)

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

A. Conditions of the Contract
B. Division 1
C. Division 26
D. Division 27
E. Division 28

1.2 DESCRIPTION

A. Summary of Work:
1. Provide a complete and tested Structured Cabling System (SCS) for the interconnections of the Local Area Network (LAN). The SCS shall include fully terminated unshielded twisted pair cables, fiber optic cabling, raceways, conduit, back boxes, copper/fiber optic termination components, station mounting hardware, fiber optic enclosures, patch panels, copper/fiber optic patch cables, relay cabinets/cabinets, and other incidental and miscellaneous premises wiring system hardware as required for a complete, tested, and usable system that is in compliance with the latest NEC, ANSI/EIA/TIA, BICSI, and Authorities Having Jurisdiction codes and standards. The installation shall comply with all applicable requirements, design guidelines, and standards in effect at the job site and as indicated in the Drawings and Specifications.
2. An IDF will be required when the distance between outlet terminations and MDF/IDF exceeds 280', including service loops. IDF's shall be selected and organized to be minimum in number while still reaching all locations to be wired.
3. If there are any discrepancies between the drawings and specification or among themselves, the contractor shall request clarification prior to providing pricing for the scope of work. If a request is not issued and a response not provided via a posted addendum, the contractor shall provide pricing for the costliest scenario and obtain clarification during the project.
4. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 QUALITY ASSURANCE

A. Acceptable manufacturers:
1. The equipment/products described herein and furnished per these specifications shall be the product of one manufacturer or must be able to obtain the full warranty of the combined solution. All references to model numbers and other detailed descriptive data is intended to establish standards of design performance, and quality, as required. The contractor shall not deviate from the part numbers listed. Any deviation from specified part numbers will result in the removal of non-specified materials and reinstallation of approved materials at no cost to the project.

2. The approved manufacturers shall provide a complete End-to-End solution with the maximum product and performance warranty offered by the specified manufacturer.
3. Only products listed in Attachment 'B' or approved in compliance with the project manual's approval requirements will be accepted.

B. Installer Qualifications:
1. The Data Cable System Installer shall be licensed and shall meet all applicable regulations of the State Department of Labor insofar as they apply to this type of system. The proposer shall be a firm normally employed in the low voltage and data cabling industry and shall provide a reference list of ten (10) large-scale projects and contact names confirming successful Structure Cabling System installations.
2. The SCS Installer shall be a Certified, local area, integrator of the manufacturer's product and must be able to provide the manufacturer's maximum available warranty for the solution on the entire SCS. The contractor's certification must have been obtained and held within 75 miles of the project's location.
3. The installing contractor must have a full-time employed RCDD (Registered Communications Distribution Designer) on staff. Current RCDD certification shall be provided in the product submittals.
4. All individuals installing the SCS must be employees of the certified installer and at least 25% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.
5. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing SCS contractor will be allowed for any portion of the SCS scope of work.

C. Low Voltage Meeting Requirements:
1. The successful Contractor shall attend a mandatory pre-construction meeting with the project's consultant individuals deemed necessary by the Owner's representative prior to the start of the work. No SCS work shall begin prior to this meeting.
2. The successful contractor shall attend a mandatory bi-weekly meeting to discuss the project progress to help aid coordination with the Owner and Other contractors.
3. Prior to the installation of any items required for this scope of work the contractor must provide a purchase order with a detailed material list for all materials to be installed. The purchase order is not required to show cost, but part numbers must be provided. The purchase order will be reviewed during one of the regularly scheduled low voltage meetings.

D. Acceptance:
1. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Warranty:
1. The selected system installer shall be a certified installing contractor of product and hold current certification. Contractor shall provide the specified manufacturer's maximum end-to-end performance warranty on all products installed. The proposer shall provide current certification documentation. The performance warranty shall be issued by the manufacturer and shall warrant that ALL cable links have been tested bi-directionally (end to end) using a Level IIIe or better tester, per TSB-67, and that all test results conform to the most current ANSI/TIA-568.2-D.
2. The warranty will also cover multimode fiber optic cabling. Performance testing shall be conducted in accordance with ANSI/EIA/TIA-526-14 Standard, method B.

3. The warranty will stipulate that all products used in this installation meet the prescribed mechanical and transmission specifications for such products as described in ANSI/TIA/EIA-568.3-D. Quality and workmanship evaluation shall be solely by the Owner/Designer and designated representatives.

1.4 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
2. National Electrical Code, current version

B. Other References:
1. TIA/EIA-568-B Commercial Building Telecommunications Wiring Standard
2. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
3. TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
4. TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.
5. EIA/TIA 455-A Standard Test Procedure for Fiber Optic Fibers, Cables, Transducers, Sensors, Connecting and Terminating Devices and Other Fiber Optic Components.
6. TIA/EIA TSB 67 Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
7. TIA/EIA TSB 72 Centralized Optical Fiber Cabling Guidelines
8. ISO/IEC 11801 Generic Cabling Standard
9. EN 50173 Generic Cabling Standards for Customer Premises
10. ANSI/EIA/TIA 526-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plan.

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.5 ABBREVIATIONS

A. The following abbreviations are used in this document:

DC	Direct Current
IDF	Intermediate Distribution Frame
MDF	Main Distribution Frame
PBX	Private Branch Exchange
UTP	Unshielded Twisted Pair

1.6 SUBMITTALS

A. Project Initiation:
1. Within fourteen (14) days of Notice to Proceed, the data network system installer shall furnish the following in a single consolidated submittal:
a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
b. Product Literature: Complete manufacturer's product literature for all cable, patch panels, cross-connect blocks, cable supports, cable labels, outlet

devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner / Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided

c. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.

d. Testing: Proposed Contractor UTP cable test result forms, fiber optic cable test result forms and a list of instrumentation to be used for systems testing.

e. Specification Compliance: A letter shall be provided stating, by section and subsection, that the SCS installer complies with the entire specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.

f. Each Submittal must have a detailed parts list with quantities.

g. Certifications: The contractor shall submit all certifications for approved products and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.

1) BICSI RCDD Certification: This certification must be held by an on-staff, full-time employee of the SCS installer. The holder must be staffed out of the office that is located within 75 miles of the projected.

2) Certifications must be obtained by the SCS installer's office that is located within 75 miles of the project and shall be a company certification, not and individual certification.

3) Certifications must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.

4) Fiber Optic Technician Certification: This certification must be held by the on-staff/on-site individual that is supervising the fiber optic installation and performing the fiber optic terminations and testing.

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight(28) days of notice to proceed:

a. Proposed circuit routing and circuit grouping plan prepared by a BICSI certified RCDD (Registered Communications Distribution Designer). The RCDD certification must be current. Identifiable, separate routing shall be shown for both the station cabling and the MDF-to-IDF tie cabling.

b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:

1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)

2) Location of sleeved wall pass-thru

3) Size of sleeve at each location installed

4) Quantity of cable passing through each sleeve

5) Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the

closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)

6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.

c. Drawing Compliance: A letter shall be provided stating that the SCS installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the Owner.

d. All subcontractors shall provide submittals to general contractor for normal distribution to Architects, Engineers and the Owner's project managers.

C. At Substantial Completion: Provide drawings, to the Owner, to reflect installed cabling with correct labeling and cable routing.

D. Close-out Procedures:

1. Two (2) copies of the following documents shall be delivered to the building owner's representative at the time of system acceptance. Close out technology documents shall be separated from all other trade's documents. The close out finals shall include:

a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.

b. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.

c. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.

d. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed a list of recommended spare parts.

e. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.

f. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.

g. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. A copy of the As-Built drawings reflecting the final locations of all cabling shall be given to the designated Owner's representative. The as-built drawings shall be prepared using AutoCAD 2012 or later. Provide the Owner with electronic versions of the as-builts on CD media.

h. All drawings must reflect final graphic numbering, point to point wiring, device address and programmed characteristics as verified in the presence

of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.

i. A copy of the manufacturer's warranty on the installed system.

j. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.

k. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)

l. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 4 hours.

m. One (1) 30" x 42" laminated floor plan sheets illustrating technology drops and cable designation with final graphic numbering. Contractor shall provide one complete floor plan sheet for each telecommunications room (MDF or IDF)

PART 2 - PRODUCTS

2.1 GENERAL

A. Installation: The cabling shall be installed per requirements of the manufacturer and the Project Documents utilizing materials meeting all applicable TIA/EIA standards. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials: Materials shall be as listed.

C. Testing: All installed cabling shall be tested 100% good after installation by the Contractor. All final test results shall be delivered to owner at completion of project. Refer to closeout requirements.

D. Ratings: All products shall be new and brought to the job site in the original manufacturer's packaging. Electrical components (including innerduct) shall bear the Underwriter's Laboratories label. All communications cable shall bear flammability testing ratings as follows:

CM Communications Cable
CMP Plenum Rated Communications Cable
CMR Riser-Rated Communications Cable

E. Initial Cable Inspection: The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of the proper gauge, containing the correct number of pairs, etc. Note any buckling of the jacket that would indicate possible problems. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

F. Cable Lubricants: Lubricants specifically designed for installing communications cable may be used to reduce pulling tension as necessary when pulling cable into conduit.

1. Approved Products
   a. Twisted-pair cable: Dyna-Blue
   b. American Polywater

G. Fire Wall Sealant: Any penetration through firewalls (including those in sleeves) will be resealed with an Underwriter Laboratories (UL) approved sealant.
   1. Approved Products
      a. 3M or
      b. Pre-approved equal

2.2 DATA CLOSET (MDF/IDF) HARDWARE

A. Equipment Cabinets/Cabinets:
Provide and install equipment cabinets and/or cabinets in locations indicated on the attached drawings for the following areas.
   1. For all MDF/IDF locations:
      Contractor shall provide and install a new floor mounted cabinet/rack system or a wall mounted cabinet where indicated on plans. Refer to floor plan and enlarged MDF/IDF room layouts for number or racks to provide at each location. If an enlarged detail is not available, the contractor shall provide the required number of racks to accommodate 100% of all termination components and an equal amount of owner equipment; as well as (1) spare rack. If an MDF/IDF is located in shared space, the contractor shall provide a floor mounted cabinet system with all required doors and side panels to secure the equipment and termination components.
   2. or Mounted Racks:
      a. 4-post Floor Mounted Rack – Refer to Attachment ‘B’ Approved Materials List
      b. 2-post Floor Mounted Rack – Refer to Attachment ‘B’ Approved Materials List
   3. Floor Mounted Cabinets:
      Floor Mounted Server Cabinet – Refer to Attachment ‘B’ Approved Materials List (provide minimum of 4 each unless indicated differently on the project floor plans)
   4. Wall Mounted Cabinets:
      Refer to Attachment ‘B’ Approved Materials List

B. Distribution Cabinet/Cabinet Grounding:
All Cabinets and/or Cabinets shall be grounded using stranded #6 AWG insulated copper conductor. Connect to service entrance grounding electrode. Provide all required bonding materials and hardware and bond to building grounding electrode subsystem at building electrical service entrance. Ground bus bar to be mounted at 4' A.F.F
   1. Approved Products
      a. Refer to Attachment ‘B’ Approved Materials List

C. Fiber Optic Patch Panels:
The enclosures used shall provide termination panels for SC type connectors and be of sufficient size and capacity to terminate 110% of the fiber count of the inside of outside fiber optic cables. Patch panels must be 19” cabinet mountable. Provide all termination accessories, fiber patch cords, enclosures and test for a complete fiber optic distribution system.
   1. Approved Products (for MDF/IDF locations): Refer to Attachment ‘B’ Approved Materials List
   2. Provide closet connector housing panels, size for 110% of total fiber count to be terminated.
   3. ALL fiber strands must be terminated in fiber housing.

D. Patch Panels: All patch cables shall be modular type patch panels to allow individual jacks to be inserted. All patch panels shall be fully populated with Jacks. Provide dust caps for all unused jacks. Furnish units that adhere to the performance requirements TIA/EIA-568A standards.

1. Approved Products: Refer to Attachment 'B' Approved Materials List
   a. Provide cable support bars at the back of all patch panels to provide additional support at rear of cabinet and panels.

E. Rack Electrical:
1. A power strip shall be installed vertical at the back of each data relay rack. Approved Products
   a. Refer to Attachment 'B' Approved Materials List
2. Provide Uninterruptable Power Supply equipment at each location indicated:
   a. At the MDF and each IDF Provide models and quantities as designated in Attachment 'B' Approved Materials List
3. Project electrical contractor to provide and install one for each UPS installed on the entire project. Coordinate receptacle type and location with the specified product requirements and the technology consultant prior to installation.

F. Cable Management Panels:
Provide cable management panels as required for horizontal and vertical cable management. Provide vertical wire management on ends and in between all racks on entire project.
1. Approved Products
   Horizontal: Refer to Attachment 'B' Approved Materials List
   Vertical: Refer to Attachment 'B' Approved Materials List
2. Provide Velcro straps for cable dressing in MDF/IDF rooms.

G. MDF/IDF Patch Cables: Cabling Contractor shall provide owner with patch cable for each data drop on entire project. These cables will provide connectivity from the front of the network patch panels to the network equipment provided by owner upon move-in. The patch cables are to be terminated properly with RJ-45 connections on each end with the proper pin-out assignments per project configuration.
1. Approved Products:
   a. Refer to Attachment 'B' Approved Materials List.
   b. All patch cables shall be factory terminated. NO EXCEPTIONS.

2.3 CABLE ROUTING/PATHWAY

A. Cable Tray: Metal cable tray shall be provided to affix to the top of all floor mount cabinets. Cable tray shall be used to brace cabinets to walls and to route cable from walls to cabinets in communication closets.
1. Refer to Attachment 'B' Approved Materials List.
2. Contractor to provide and install all applicable installation accessories.

B. Cable Support System: All low voltage cabling shall be installed and supported using a PANDUIT® Corp. J-MOD™ modular cable support system at 48" intervals unless installed in conduit. Do not exceed manufacture recommendation for the quantity of cables supported in an individual support.

C. All cable bundles shall be grouped together using plenum rated Velcro for the entire run above and below the ceilings.

D. Conduit Bushings shall be installed prior to the installation of any cable. If cable is found to be installed without the bushing the cable will have to be removed and re-installed. No cut bushings will be accepted. If cable damage occurs during any portion of the installation, the cable will be removed and replaced at no cost to the project. This item will be strictly enforced and adhered too.

E. The projects electrical contractor shall provide and install all metallic conduit and backboxes indicated to be installed on the drawings. It is the SCS installer's responsibility to coordinate all conduit requirements with the electrical contractor to ensure that all conduit sizes and locations are correctly installed. If box locations and conduit sizes are found to vary from the project documents after installation the SCS installer will bare all financial responsibility to ensure these items are installed correctly. The RCDD for the SCS will be responsible for ensuring conduit sizes are sufficient for cable count while maintaining a 40% fill ratio.

2.4 STATION WIRING

A. Wire: The data and voice wire provided for all outlets shall be unshielded twisted pair, four-pair, 24 AWG solid copper conductor, meeting the intent and quality level of the TIA/EIA-568-A Commercial Building Wiring Standard. Refer to floor plan and data outlet legend for number of active data ports to specified faceplates.
   1. Approved Products: For all voice and data connections:
      a. Refer to Attachment 'B' Approved Materials List

B. Testing: The four-pair UTP cable must be UL Performance Level tested. Each 1000-foot spool must be individually tested with test results affixed to the spool. All cable must be provided on new 1000-foot spools. No shorts will be allowed.

C. Rating: Cable installed in conduit shall be non-plenum rated. Cable not installed in conduit shall be plenum rated if installed in plenum ceiling space, non-plenum rated otherwise.

D. All cable shall be routed to the center of the room in which it is serving and then route to the outlet location that it is intended for. Provide a 5' service loop in the center of the room and 5' service loop at each workstation outlet properly supported above ceiling. All workstation service loops shall be made in figure eight configurations, no exceptions.

E. Provide minimum of 10' service loop at all headend locations properly supported above ceiling.

F. All underground or cable to be routed outside building even if it's in conduit should be outdoor cable see Material list for part numbers.

G. Color standards;
   1. Reference Attachment 'A'

2.5 STATION HARDWARE

A. Flush Mount Jacks: Flush mount jacks shall be high quality RJ45 modular jacks with circuit board construction and IDC style or 110-style wire, T568B terminations. Jacks shall meet EIA/TIA TSB40 recommendations for connecting hardware.
   1. Approved Products: Refer to Attachment 'B' Approved Materials List
      a. Connector Insert Color per System:
         1) Reference Attachment 'A'
   2. All blank inserts color shall be coordinated prior to procurement.

B. Faceplates: Faceplates shall be a minimum of 4-port.
   1. Approved Products: Refer to Attachment 'B' Approved Materials List

C. Outlet Patch Cables: Cabling Contractor shall provide owner with patch cable for each data drop on entire project. Each cable will be terminated properly with RJ45 connections on each end with appropriate pin-out assignments per project configuration.
   1. Approved Products:

a. Patch cords shall be stranded copper, matching the category 0f the installed cable.
b. Patch cable colors to be coordinated with jack color of each system type.
c. All patch cables shall be factory terminated. No exceptions
e. Reference Attachment ‘A’ for supplemental information
f. Reference Attachment ‘B’ for Approved Materials List

D. Provide data outlet for irrigation controllers. Coordinate location with landscape consultant.

E. Provide data outlet for time clock appliance in main custodian office.

F. Provide OSP or flooded/gel filled category cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This applies to station or horizontal cable runs only.

G. Provide 110 style transition module for station or horizontal cabling to facilitate the transition from plenum rated cabling to OSP for any connection made in the ceiling plenum transitioning to underground conduits.

2.6 FIBER OPTIC PRODUCTS

A. Singlemode:
1. Single mode fibers, each with a color-coded PVC tight buffer shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.
2. Approved Products: Refer to Attachment ‘B’ for Approved Materials List

PART 3 - EXECUTION

3.1 GENERAL

A. Fire Wall Penetrations:
The contractor shall avoid penetration of fire-rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Allowable Cable Bend Radius and Pull Tension:
In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturers allowable bend radius and pull tension data for the maximum allowable limits.

C. Cable Lubricants:
After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

D. Pull Strings:
Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.

E. Conduit Fill:
Conduit fill shall not exceed 40%.

F. Damage:
1. The Contractor shall replace or rework cables showing evidence of improper

handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).

2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

G. Clean Up:
All clean up activity related to work performed will be the responsibility of the Contractor and must be completed daily before leaving the facility.

H. Conduit and Back Boxes:
1. The Contractor shall ensure that the appropriate back boxes and conduits, for the project, are provided as required.
2. One (1) 1" conduit will be required each outlet that serves one to a maximum six (6) category 6 or a maximum of four (4) category 6A cables. Provide additional conduit for cable counts that exceed this number.
3. One (1) double gang deep box will be required for each technology outlet. All boxes except Presentation outlets will be required to have a single gang reducer ring.

3.2 EQUIPMENT CABINET CONFIGURATION

A. Equipment Cabinets:
Equipment racks shall be assembled and mounted in locations shown on the Drawings and as detailed. Each rack shall be securely mounted to the floor and braced to the wall with cable tray in accordance with the manufacturer's instructions and recommendations. Racks shall be mounted such that the side rails are plumb with vertical cable management panels. Racks to be located such that future expansion can occur without relocating existing racks. Racks shall be grounded in accordance with NEC requirements.

B. Wire Management Components:
Horizontal cable management panels shall be installed directly above and below each patch panel. Vertical cable management panels shall be installed on each side of the cabinet.

C. Cable Placement:
Cable installation in the Wiring Closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing area horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

D. Cable Routing:
Cable shall be routed as close as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the Wiring Closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

E. Installation:
All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels. Cable bundles shall not exceed more than 48 cables to patch panel.

F. Hardware:
Provide cabinet and jack panel hardware as required for all data station wiring.

3.3 STATION WIRING INSTALLATION

A. General:
Cabling between wiring closet and workstation locations shall be made as individual home runs. No intermediate punch down blocks or splices may be installed or utilized between the wiring closet and the communications outlet at the workstation location.
1. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one and one-half inches of unsheathed UTP cable at either the wiring closet or the workstation termination locations.
2. All cable shall be routed to the center of the room in which it serves before routing to the outlet location and a 5' service loop shall be provide. An addition 5' service loop shall be provided above ceiling at the outlet location. All service loops shall be figure 8 loops.

B. Exposed Cable:
All cabling shall be installed inside walls or ceiling spaces whenever possible. Exposed cables and/or cables routing through mechanical rooms, electrical rooms, or restrooms shall be installed inside conduits, unless noted otherwise on the project drawings.
1. Additional exposed cable runs will require Owner approval, and will only be allowed when no other options exist.
2. All cable routing through conduits and sleeves shall maintain a 40% maximum conduit fill ratio.

C. Placement:
All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner's efficient use of their full capacity.

D. Cable Routes:
All cabling placed in ceiling areas must be in conduit, or Panduit Corp. J-MOD modular cable support with Velcro cable wrap at each location. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure to which attached and that are suitably sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section. Contractor shall adhere to the manufacturer's suggested fill ratio for each size cable support installed. No support shall have more than 48 cables.
1. Attaching cable to pipes or other mechanical items is not permitted. Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be routed down the corridors; parallel or perpendicular to building structure. Multiple cables to be bundled together at and between each cable support installed.
2. Contractor shall be responsible for coordinating with other trades on the project so that the installed cable pathway does not interfere with the installation of other systems to insure that mechanical ducts, pipes, conduits, or any other above ceiling systems are not putting unnecessary stress on any portion of the install SCS.
3. All (48) cable bundles shall be routed directly to the MDF or IDF that serves the area. All bundles shall remain separated for the length of the cable run.
    a. Provide data outlet for irrigation controllers. Coordinate location with landscape consultant.
    b. Provide data outlet for time clock appliance in main custodian office.
    c. Provide OSP or flooded/gel filled cat6 cable at any outdoor data outlet or data outlets served by cabling that travels through subsurface conduit. This

applies to station or horizontal cable runs only.

3.4 STATION HARDWARE

A. Flush Mount Jacks:
Flush mount jacks shall be mounted in a faceplate with back box.

B. Placement:
1. Where possible, the communications outlet shall be located so that its centerline is 18 inches above floor level or 12 inches above permanent bench surfaces. Outlets shall not be mounted on temporary, movable, or removable surfaces, doors, or access hatches.
2. Outlets shall be installed within 3'-0" of power outlets

C. RJ-45 Jack Pin Assignments:
1. Pin connections for data station cable outlets and patch panels shall match EIA/TIA 568 modular jack wiring recommendation T568B.
2. Pin connections at data jack panels shall match pin connections at outlets (straight through wiring)

3.5 CABLE TESTING REQUIREMENTS

A. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.

B. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and timetable for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor's use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.

D. Acceptance shall be subject to completion of all work, successful post-installation testing which yields 100% PASS rating, and submittal and approval of full documentation as described above. Tests with the "* PASS" (asterisk) will not be acceptable. These circuits must be repaired to meet "PASS".

E. Errors: When errors are found, the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by Owner.

F. Twisted Pair Cable Testing:
1. At a minimum, the Contractor shall test all station drop cable pairs from Data Closet termination patch panels to outlet device RJ45 jacks. Products shall be tested for compliance with ANSI/TIA/EIA 568A and ISO/IES 11801. Test equipment used shall meet TIA/EIA TSB-67, Level II accuracy. Further, the contractor shall have a copy of TSB-67 in their possession and be familiar with its contents.
2. Each wire/pair shall be tested at both ends for the following:
   a. Wire map (pin to pin connectivity)
   b. Length (in feet)
   c. Attenuation
   d. Near end cross talk (NEXT)

e. Power Sum

3. Test equipment shall provide an electronic and printed record of these tests.
4. Test results for each four-pair UTP cable must be submitted with identification to match labels on all patch panel ports and RJ45 jacks and must match as-builts associated with that cable.

G. Fiber Optic Cable Testing:
1. Testing device for fiber optic cables shall be a high quality OTDR (Optical Time-Domain Reflectometer) equipped with a printer. The printed data shall show, in addition to any summary information, the complete test t0.and all relevant scale settings. The OTDR must have the capability to take measurements from bare fiber strands as well as SC connector terminations.
2. All fiber optic cable shall be tested on the reel before installation to ensure that it meets the specifications outlined herein.
3. After installation the Contractor shall test each fiber strand in accordance the EIA 455-171 Method D procedures (bi-directional testing) at both 850nm and 1300nm for multimode or 1310nm and 1550nm for single mode. A form shall be completed for each cable showing data recorded for each strand including length, total segment (end-to-end) loss (dB) and connector losses (dB) at each end. In addition, the printed data strip for each strand shall be attached to the form. Patch cables shall also be tested.
4. Acceptable fiber optic connector loss shall not exceed .75dB per mated pair. The Contractor is responsible for obtaining minimum loss in fiber connections and polishing per manufacturer specifications.
5. Singlemode:
a. Singlemode fibers shall have a maximum attenuation of 1.0 dB/km at 1310 nm and 1.0 dB/km at 1550 nm.

3.6 INSPECTION

A. Conformance to the installation practices covered above is to be verified when completed. In some cases, the Owner/Designer may inspect before acceptance.
1. Written Test Report:
a. Complete test results, including actual values associated with tests.
b. Show all certifications for telecommunications wiring systems.
c. Include cable maps showing each cable route and keyed to cable labels. Provide owner with complete floor plans identifying outlet location and cable routing drawing in AutoCAD format. Provide electronic copy of drawings to owner in AutoCAD version 2012 or greater.
d. Documentation of outlet, cable and cabinet labeling system.

B. After performing all tests, tabulate results and bind together in format acceptable to Owner. Installer shall provide written certification in the test report that telecommunications cable is properly installed, and test results certify system to all specified standards.

ATTACHMENT 'A'
Project Specific Scope of Work and Instructions

PART 1 – SUMMARY OF WORK

1.1 DESCRIPTION OF WORK

A. This project consists of the provision and installation of a Structured Cabling System (SCS) to furnish a Network Cabling Infrastructure as required to support network connectivity to workstations, telephones, video surveillance, access control, building automation, electrical lighting, and any other system requiring network connectivity. This project is the new construction of Elementary School #38, for Lamar Consolidated Independent School District.

B. The work includes provision and installation of a complete Cabling System (SCS) in compliance with these specifications and associated drawings, pre-proposal addenda, change orders, change directives and any other documents issued both pre-proposal and during the project.

C. The SCS Installer shall comply with all conditions of the contract and "Division 1 –General Requirements" as they apply to the SCS Scope of Work. It shall be the responsibility of the SCS Contractor to make themselves familiar with all documents.

D. It should not be assumed that any portions of a complete and functional system are to be furnished and/or provided by anyone, other than the SCS installer, unless specifically stated otherwise.

1.2 STRUCTURED CABLING SYSTEM – ADDITIONAL INSTRUCTIONS

A. Base Proposal:
   1. The SCS Installer shall provide and install an End-to-End Structured Cabling System as per these specifications and associated drawings. The Base bid SCS shall consist of:
      a. Category 6 cable and connectivity to each Video Surveillance Camera, Voice/Data Outlet, Front Row Classroom Speaker Assembly, and any other locations requiring Local Area Network Connectivity.
      b. Category 6A cable and connectivity to each Wireless Access Points.
      c. Each connectivity solution be a complete Channel Solution; consisting of jacks, patch panel, and patch cables.
      d. Each channel solution shall be color coded to the system in which it serves.
   2. The products specified in Attachment 'B' are to require quality, functionality, color, and standards. The following shall be considered preapproved equivalent for each specific portion of the SCS.
      a. Category 6/6A copper cabling, termination components, and patch cables
         1) Panduit
      b. Fiber Optic Cabling and Components:
         1) CommScope
         2) Corning
         3) OCC
         4) Panduit
      c. Metals (racks, cable managers, and cable tray):
         1) B-Line
         2) Chatsworth

3) CommScope
4) Panduit

1.3 COPPER PATCH PANELS

A. The SCS Installer shall provide and install patch panels as per the instructions below.
1. 24-port patch panels shall only be used for copper tie cables and demarcation extensions.
2. Provide dedicated, 48-port patch panels for each of the following system (reference color code chart for designated insert and patch panel color coding per system):
a. LAN and IP Telephones
b. Wireless Access Points,
c. Video Surveillance Cameras
d. IP Intercom

1.4 COPPER AND FIBER OPTIC PATCH CABLE LENGTHS

A. The SCS Installer shall provide copper and fiber optic patch cables as per the instructions below. All patch cables shall be factory terminated and warrantied for the copper and fiber solutions specified.
1. MDF/IDF Copper Patch Cables:
a. Patch cables shall be category 6
b. Patch cables for wireless access points shall be category 6A
c. Provide one patch cable for each port on the entire project
d. Patch cables to be installed by network equipment installer/programmer
e. Patch cable lengths
1) 95% shall be 1’
2) 5% shall be 7’

2. Work Area Outlet Copper Patch Cables:
a. Patch cables shall be category 6
b. Provide one patch cable for each port on the entire project
c. Patch cables to be installed by the owner.
d. Patch cable lengths
1) 95% shall be 10’
2) 5% shall be 15’

3. Wireless Access Point Copper Patch Cables:
a. Patch cables shall be category 6A
b. Provide one patch cable for each port on the entire project
c. Patch cables to be installed by wireless system installer.
d. Patch cable lengths
1) Interior Access Points: 100% shall be 10’
2) Exterior Access Points: 100% shall be 15’

4. Video Surveillance Camera Copper Patch Cables:
a. Patch cables shall be category 6
b. Provide one patch cable for each port on the entire project
c. Patch cables to be installed by the Video Surveillance System Installer.
d. Patch cable lengths
1) Interior Access Points: 100% shall be 10’
2) Exterior Access Points: 100% shall be 15’

5. IP Intercom Copper Patch Cables:

a. Patch cables shall be category 6
b. Provide one patch cable for each port on the entire project
c. Patch cables to be installed by the Video Surveillance System Installer.
d. Patch cable lengths
    1) 100% shall be 10'

6. MDF/IDF Fiber Optic Patch Cables:
    a. Patch cables shall be single-mode
    b. Patch cable shall be duplex, LC to LC
    c. Provide quantity sufficient for connecting all network equipment plus 20% for growth.
    d. Patch cables to be installed by network equipment installer/programmer
    e. Patch cable lengths
        1) 100% shall be 3 meters

1.5 SYSTEM SPECIFIC COLOR REQUIREMENTS

A. The following information shall apply to the complete SCS Channel. All horizontal category cable, patch cables, outlet terminations, and closet terminations shall be provided in the colors designated below:

Item	Description	Horizontal Cable	Insert	Patch Cables
1	Data	Blue	Ivory	White
2	Wireless	Blue	Red	Red
3	Camera	Blue	Green	Green
4	IP Intercom	Blue	Blue	Blue
5	Access Control	Blue	Yellow	Yellow
6	BMCS	Blue	Pink	Pink
7	FSD/IVD	Blue	Purple	Purple

1.6 DOCUMENTATION

A. Labels:
The Contractor will label all outlets using permanent/legible typed or machine engraved labels approved by the Owner (no handwritten labels permitted). Label patch panels in the wiring closet to match those on the corresponding data outlets. The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-builts and to final test reports.

1. The following nomenclature should be used when labeling data/voice jacks:
    a. All cables being served by MDF closet shall begin with '1' all IDF served cables shall begin with a numerical digit (2 thru 25….) designating the specific IDF's identification.
    b. Next identification letter shall refer to patch panel that is serving outlet (A, B, C…)
    c. Next identification shall note what # data port on patch panel (01 thru 48).

Example:
Label of an outlet served by the 23rd port, of the 3rd patch panel from top of rack, located in IDF-2 shall read
2-C-23
Label of an outlet served by the 5th port, of the 2nd patch panel from the top of rack,

located in the MDF shall read
1-B-05

B. Floor Plan:
A floor plan clearly labeled with all outlet jack numbers shall be included in the as-built plans.

C. Cables: All cables shall be labeled at both ends. This includes but not limited to horizontal voice and data cabling, copper backbone tie cables, and fiber optic cables.

D. Fiber Optics: Fiber optic strands shall be labeled at both ends on the fiber distribution panel.

E. Equipment racks: Equipment racks shall bear at least one indicating label indicated MDF or IDF. If rack is installed in IDF, label shall include IDF #.

F. Access Points: Label ceiling grid with digital label according to location installed and a bright orange 3/4” round dot sticker.

ATTACHMENT 'B'
Manufacturer and Material List

The Communications Contractor shall perform no portion of the work requiring submittal and review of record drawings, shop drawings, product data, or samples until the respective documentation has been approved by project's Technology Consultant.

MATERIAL LIST

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
B-Line	4-Post, Adjustable Server Rack; 84"H; 45 RMU; #12-24 Threaded Mounting Holes; Black	SB8370844DFB	Provide as shown on Drawing, minimum of one (1) in the Building's MDF.
B-Line	2-Post Relay Rack; 84"H; 45 RMU; #12-24 Threaded Mounting Holes; Black	SB556084XUFB	Provide as shown on Drawing, minimum of one (1) in the Building's MDF and each IDF.
B-Line	Front/Rear, 6-inch, Vertical Cable Manager	SB86486D084FB	Provide one (1) between each rack and at both ends of each rack system
B-Line	Front/Rear, 19", 2RU, Horizontal Cable Manager	SB87019DX2FB	Provide one (1) above and below each pair of 24-port patch panels and each 48-port patch panel installed. Provide the duplicate amount for owner installation.
Middle Atlantic	EIA compliant 19" pivoting equipment rack, black in color.	SR-40-32	Provide at locations designated on the project drawings.
Middle Atlantic	Perforated Front Door with lock	LVFD-40	Provide one (1) for each pivoting equipment rack on the entire project.
Middle Atlantic	8-Outlet 15A Rack mount Power/Light	PDLT-815RV-RN	Provide one (1) for each pivoting equipment rack on the entire project.
Middle Atlantic	11-Outlet 15A Power/Cooling	PDCOOL-1115R	Provide one (1) for each pivoting equipment rack on the entire project.
B-Line	Grounding Busbar, 12", Kit	SBTMGB12K	Provide one (1) in each MDF and IDF on the entire project
B-Line	Copper Compression Lug, 2 Hole, #6 AWG	SB47902	Provide at TGBB and at each point bonding to the rack system.
B-Line	Universal Cable Runway 12 in (305mm) W, Black	SB17U12BFB	Provide as shown on drawings. Tray shall route to and between all racks, in each MDF/IDF, on the entire project.
B-Line	Cable Runway, 90° radius horizontal bend, 12 inch, black	SB17HRB12FB	
B-Line	Cable Runway, 90° radius vertical bend, 12 inch, black	SB17VRB12FB	
B-Line	Rack-to-Runway Mounting Kit, black in color	SB213312FB	
B-Line	Runway Stand-Off (Elevation) Kit, 4" - 6"	SB227R62FB	

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
B-Line	Cable Runway, wall angle support kit, 12 inch, black	SB227R6FB	
B-Line	Triangular Support Bracket. Made of 1/4" x 2" aluminum bar. Load rating is 100 lb (45.4 kg). Black	SB21318KFB	
B-Line	Cable Runway, protective end cap kit (2 caps), black	SB21C	
B-Line	Cable Runway, junction splice kit, black	SB2101AFB	
B-Line	Cable Runway, butt splice kit, black	SB166BFB	
OCC	Fiber enclosure, rack mount, 1RU, sliding, 3 adapter plates, black	RTS1U-3APB	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the IDFs, if not shown on drawings
OCC	Fiber enclosure, rack mount, 2RU, sliding, 6 adapter plates, black	RTS2U-6APB	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the MDF/IDFs, if not shown on drawings
OCC	Fiber enclosure, rack mount, 4RU, sliding, 12 adapter plates, black	RTS4U-12APB	Provide as per the project drawings. Or as required, to accommodate all fiber optics in the MDF/IDFs, if not shown on drawings
OCC	HD Adapter Plate, 12-port, Dual SC, Single-mode	6112SMDSCHD	Provide as required to accommodate 110% of all fiber terminated in each MDF/IDF
OCC	4-Strand, Indoor/Outdoor, Plenum Rated, B-Series Breakout, 9/125µm Single-Mode	BX004KSLX9YP	Provide from the MDF to the Marque Sign.
OCC	Plenum, 12-Strand, Tight-Buffered, Interlocking Armored, 9/125µm Single-Mode	DZ012TSLA9YPI8	
OCC	SM LC pre-radius connector for use on 900m buffered fiber, Blue Housing	FXC-SC8-*	* to be replaced with numeric value depicting the quantity of connectors in a single package
Panduit	Patch Panel, 24 Port, Modular Snap In, Black	CPPL24WBLY	Provide in quantities as required to terminate 100% of all copper backbone cable. Reference project drawings.
Panduit	Patch Panel, 48 Port, Modular Snap In, Black	CPPL48WBLY	Provide in quantities as required to terminate 100% of all distribution structured cabling, plus 25% for future growth. Reference project drawings. Voice/Data, Security, and WLAN shall have dedicated panels per system.
Panduit	Copper Cable, Enhanced Cat 6, 4-Pair, 23 AWG, UTP, CMP, 1000ft/305m	PUP6504**-UY	** to be replaced with numeric character depicting the color of the cable. Colors shall comply with designated color of the system each cable is provided for.

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Panduit	Copper Cable, Cat 6A, 4-Pair, 23 AWG, UTP, CMP, 1000ft/305m	PUP6A04**-UG	** to be replaced with numeric character depicting the color of the cable. Colors shall comply with designated color of the system each cable is provided for.
Panduit	Mini-Com Module, Cat 6, UTP, 8 pos 8 wire, Universal, TG Style	CJ688TG**	** to be replaced with numeric character depicting the color of the module. Colors shall comply with designated color of the system each IO is provided for.
Panduit	Mini-Com Module, Cat 6A, UTP, 8 pos 8 wire, Universal, TG Style	CJ6X88TG**	*** to be replaced with numeric character depicting the color of the module. Colors shall comply with designated color of the system each IO is provided for.
Panduit	Faceplate, 2 Port, Single Gang, Classic, Stainless Steel	CFPL2SY	
Panduit	Faceplate, 4 Port, Single Gang, Stainless Steel	CFP4SY	
Panduit	Copper Patch Cord, Cat 6, UTP Cable	UTPSP^**	^ to be replaced with a numeric value depicting the patch cable length. ** to be replaced with alpha or numeric character depicting the color of the patch cable. Colors shall comply with designated color of the system each cable is provided for. Length to comply as stated in these specifications.
Panduit	Copper Patch Cord, Cat 6A, UTP Cable	UTP6A^**	^ to be replaced with a numeric value depicting the patch cable length. ** to be replaced with alpha or numeric character depicting the color of the patch cable. Colors shall comply with designated color of the system each cable is provided for. Length to comply as stated in these specifications.
Panduit	Mini-Com® surface mount box accepts two Mini-Com® Modules	CBX2WH-AY	Provide one at every above ceiling outlet location. Including, but not limited to: Ceiling Mounted Projectors, Wireless Access Points, and Video Surveillance Cameras

MANUFACTURER	DESCRIPTION	PRODUCT NUMBER	NOTES
Leviton	QuickPort In-Ceiling Bracket	49223-CBC	Provide one at every above ceiling outlet location. Including, but not limited to: Ceiling Mounted Projectors, Wireless Access Points, and Video Surveillance Cameras

END OF SECTION 27 10 00

SECTION 27 51 23 IP INTERCOM SYSTEM

PART 1 – GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

A. Conditions of the Contract
B. Division 1
C. Division 26
D. Division 27
E. Division 28

1.2 WORK INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to this Section.

B. Furnish and install all equipment, accessories, cabling, devices, and materials in accordance with the project specifications and drawings to ensure a fully operational intercom, master clock, secondary clock, and class change time tone communication system of the highest quality. The system shall be integrated with the classroom audio/video systems in order to utilize the same classroom speaker for intercom and A/V purposes – refer to Section 27 61 00.

C. It shall be the responsibility of the Electrical contractor to provide and install all conduit systems, standard electrical boxes, and operating power for the communication system as outlined on the project drawings.

D. The Intercom Communication System Contractor (The Contractor) shall coordinate all system requirements.

E. Equipment specified herein is designed to provide specific functional and operational characteristics. It is the responsibility of the Intercom System Contractor to provide all features and functions as outlined in these specifications.

F. The Contractor shall provide one (1) analog terminal adapter CMP-500 to the building telephone system via a dedicated line. This will provide transparent access from the telephone system to the paging system. In addition, the telephone interface shall support a security code if desired. The telephone interface shall recognize valid DTMF tones as logical paging zone settings.

G. Provide testing, as described in Part 3, for all requirements shall be performed with all cable runs and wiring devices in place.

H. Provide a service contract and warranty as outlined in Part 3 of these specifications.

I. Provide all documentation and training as outlined in these specifications.

1.2 CODES AND REGULATIONS

A. NFPA 70, National Electrical Code.

B. NFPA 101, Code for Safety to Life from Fire in Buildings and Structures.
C. UL 50, Enclosures for Electrical Equipment.
D. FCC Rules, Part 76.
E. All applicable parts will be FCC Class B approved.
F. Americans with Disabilities Act.
G. Texas Accessibility Standards.
H. International Building Codes (IBC).
I. Local and State Building Codes.
J. All requirements of the local Authority Having Jurisdiction (AHJ).

1.3 SUBMITTALS

A. Submit a complete submittal package within 30 calendar days after award of this work for approval. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

B. Submittal may be electronically transmitted in PDF file format (preferred) or paper copies may be provided in quantities indicated in Division 1. Paper copies shall be organized including index tabs in a 3-ring black binder of sufficient size.

C. Quality Assurance Submittal:
1. Letter from Intercom Equipment Manufacturer stating that the Contractor is an Authorized Factory Distributor for the area where the project is located.
2. Product Data Submittal including special boxes, cable, and other material as requested by the Architect including:
a. A cover sheet with the name and location of the project, the name, address, and telephone number of the Contractor, and the name, address, and telephone number of the submitting sub-contractor. Include on or after the cover sheet sufficient space for review stamps.
3. An indication of any deviations from Contract Document requirements, including variations and limitations. Show any revisions to equipment layout required by use of selected equipment.
4. A product data index and complete equipment list including for each product submitted for approval the manufactures name and part number, including options and selections.
5. Cut sheets or catalog data illustrating 1 the physical appearance, size, function, compatibility, standards compliance, and other relevant characteristics of each product on the equipment list. Indicate by prominent notation (an arrow, circle, or other means) on each sheet the exact product and options being submitted.
6. Submit design data, when the scope of work requires, including calculations, schematics, risers, sequences, or other data.
7. Any resubmittal shall include a complete revised equipment list and any product data that is revised.

D. Submit shop drawings locating all components of the intercom system and indicating circuit routing, cable type, and gauge. Shop or coordination drawings shall include information that will allow to the Contractor to coordinate interdisciplinary work and when necessary guide the manufacturer or fabricator in producing the product. Shop or coordination drawings shall be specifically prepared to illustrate the submitted portion of work, this may require diagrams, schedules, details, and accurate to scale equipment and device layouts prepared using a CAD or BIM engineering drawing program.

1.4 QUALIFICATIONS OF A PROPOSED CONTRACTOR

A. Proposed contractors who do not currently possess the necessary qualifications, trained and experienced personnel, financial capacity, and meet the other requirements herein described will be disqualified.

B. The proposed contractor, as a business entity, shall be an authorized distributor and designated representative of the equipment manufacturer, with full warranty privileges.

C. The proposed contractor shall have been actively engaged in the business of selling, installing, and servicing commercial building commercial communication systems for a period of at least 5 years.

D. Recently formed companies are acceptable only if specific pre-approval is requested, and granted by the Architect/Engineer, based on experience of key personnel, current and completed projects, and all licensing requirements are met 10 working days prior to the contract proposal date.

E. The proposed Contractor shall have an office within 150-miles of the job site, staffed with trained technicians who are qualified and licensed to supervise the installation, to be responsible that the system is installed as submitted, to conduct system start up and perform a 100 percent operational audit of all installed devices, to instruct the Owners representatives in the proper operation of the system, and to provide service throughout the warranty period.

F. The contractor shall be capable of dispatching technicians to repair a system within six hours of a service request.

G. The proposed contractor shall be fully experienced in the design and installation of the type of system herein specified and shall furnish with the contract proposal an itemized list of the installations of the type specified herein.

H. The list shall include the name of the project, date of completion, the amount of the contract, the name, and telephone number of a qualified person to contact for reference. This list must contain at least two (2) projects within a 150- mile radius of the school district to allow school administration officials to visit the job site for review of the system installation and service.

I. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

J. The Contractor shall employ factory-trained technicians capable of supporting the maintenance of the system. No contract employees are allowed unless they have been to the factory service school within the last 18 months. A certificate of this 1 training shall be provided with the contractors' submittal.

K. The Proposed Contractor shall not have any grievances or complaints of record regarding workmanship, code compliance, or service response. A Proposed Contractor that has any prior finding(s) of a code violation or has any litigation in process concerning the installation of a communication system is unacceptable.

L. The ability of a proposed Contractor to obtain plans and provide a performance bond shall not be regarded as the sole qualification of the Contractors' competency and responsibility to meet the requirements and obligations of the contract.

M. The Builder shall be satisfied that a proposed Contractor meets all the requirements

expressed herein before including the Contractor's proposal in the project.

N. The Owner may investigate, as they deem necessary to determine the ability of the proposed Contractor to perform the work. The proposed Contractor shall furnish to the Owner with any information or data requested for this purpose.

O. The Owner reserves the right to reject any contract proposal if the evidence submitted, or their investigation, fails to indicate that the Contractor is qualified to fulfill of any part of the contract or to complete the work contemplated therein.

P. The Owner reserves the right to reject the proposal of any Contractor who has previously failed to perform properly, or complete on time, contracts of a similar nature.

PART 2 – PRODUCTS

2.1 GENERAL

A. All basic equipment for which there are Underwriters' Laboratories Standard requirements shall be listed by Underwriters' Laboratories and be so labeled, or shall conform to their requirements, in which case, certified statements to the effect shall be furnished by the manufacturer with a copy of an examination report by a recognized laboratory acceptable to the Local Authority Having Jurisdiction.

B. All equipment and components shall be installed in strict compliance with manufacturers' recommendations and the requirements of the components UL listing. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, electrical requirements, cable types, and physical equipment sizes, etc., before beginning system installation.

C. All date keeping hardware, firmware, and software provided shall be fully compliant with the calendar year designated in four-digit date format. Any time equations must function normally, leap year, and daylight savings time must be supported.

D. All basic equipment shall be new and shall be the latest product of a manufacturer of established reputation and experience of quality electronic equipment. Model numbers indicate current equipment types; if later models exist, the Contractor shall provide those. The manufacturer shall have supplied similar apparatus to comparable installations rendering satisfactory service for at least three (3) year.

E. It is the responsibility of the Intercom Communication System Contractor 1 to provide all features and functions as outlined in these specifications. The intercom shall accept standard DTMF signals from the building telephone system through an analog telephony interface #CMP-500.

F. All like devices shall be of the same manufacturer and model number.

G. Only equipment devices have been shown on the contract drawings. Specific wiring between equipment has not been shown.

H. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., speakers shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

I. The installation shall be subject to approval, inspection, and test of the Architect/Engineer.

2.2 ACCEPTABLE MANUFACTURES

A. Descriptions and details, acceptable manufacturers' names listed, and specific manufacturer and model number items indicated in the plans and specifications shall establish a standard of quality, function, and design. Manufacturers and model numbers listed "no exceptions" shall not be substituted without specific notice in an addendum. Otherwise, where a specific manufacturer's product is indicated, products of other manufacturers listed as acceptable may be submitted for approval based on the substitute product being, in the opinion of the Engineer, of equivalent or better quality than that of the product specified.

B. Proposed contractors wishing to propose any product substitution must do so in writing to the specifying authority at least ten (10) days prior to the proposal opening.

C. For manufacturers equipment or models other than that specified, the proposed contractor shall supply proof that such substitute equipment equals or exceeds the features, functions, performance, and quality of the specified equipment. Proposals must include detailed information showing all deviations from the system as specified

D. Substitute products for which the proposed contractor does not obtain prior approval will not be considered acceptable for this project. Final approval of alternate products shall be based on the decision of the Owner and Architect. Prior approval to make a proposal for this project does not automatically ensure products will be an acceptable equivalent.

E. It is the responsibility of the Contractor to provide all features and functions as outlined in these specifications. The functions and features specified are vital to the operation of this facility; therefore, inclusion in the list of acceptable manufacturers does not release the contractor from strict compliance with the requirements of this specification.

F. The model numbers used shall constitute the quality and performance of the equipment to be furnished. The **Conductor School Communication and Safety System by FrontRow, 1690 Corporate Circle, Petaluma, California** is acceptable basis of design; any other proposed manufactures must be pre-approved.

2.3 RELATED WORK - NETWORK CONNECTIVITY

A. Refer to Section 27 10 00 – Structured Cabling Systems for all Ethernet network drop connections. All Ethernet cabling and jacks used to connect to the building network shall be provided as indicated on the plans under Section 27 10 00. All system devices provided in this section, which require an Ethernet network connection shall be coordinated 1 with this contractor.

B. All system devices provided in this section that require a network connection shall be coordinated with district IT department to be assigned TCP/IP configuration settings including a static IP address, domain, gateway, and subnet mask.

C. The intercom system will require streaming devices/server in a single Class C subnet 255.255.255.0 attached to the server primary network port.

D. This contractor will implement all device network configuration and device programming required to provide a complete and functional system under this specification including any special connecting network jumpers and all other types of cabling, and interconnect wires

and cables required.

2.4 INTERCOM AND PUBLIC ADDRESS OPERATION

A. Each classroom shall be equipped with a ezRoom Voice & Alert Trio (2x2 enclosure) with call-button, talkback intercom, double gain #CB-2050 and built-in ceiling speaker (refer to section 27-61-00 Integrated Audio-Video Systems for determination of type of speakers in the classroom) with a classroom name/number on the admin station user interface.

B. Each office and special use area (conference room, gym, cafeteria, library, etc.) shall be equipped with intercom ceiling speaker(s) Quam-Nichols Company SYSTEM 5/8 or equivalent shallow depth Qualm with a name/number on the admin station user interface.

C. Common zone paging speakers shall serve all corridors, passageways, and janitors' closets.

D. Zone exterior speakers separately.

E. The system shall allow the classroom call switch to place a normal call by pressing the button once. Alert call buttons shall be possible with the addition of a dedicated push button if desired.

F. All speakers: classroom, office, corridor, exterior, gymnasium, cafeteria, and common areas shall broadcast announcements as zoned. Speakers shall produce clear human voice reproduction at 10 dBA over ambient noise levels minimum (i.e. corridors at class change) but never less than 65 dBA or more than 110 dBA throughout all normally occupiable areas.

G. Provide as indicated on plans an Intercom Administrative Station #FR-ADMIN to provide the following functions
1. Identify incoming calls by their designated classroom numbers. Alert calls shall initiate a distinctive audible alert and visual indication.
2. Provide facilities for answering calls registered in the display by a single "response" screen button.
3. Provide the capability to broadcast all-call or zoned paging announcements over all interior, exterior, and corridor speakers. Zone announcements to exterior speakers separately.
4. The system shall provide facilities for calling a staff (classroom) station by selecting the classroom or other location name from the graphical user interface.
5. The central microprocessor control equipment shall be of modular design, 1 expandable to 250 stations. All programming shall be accomplished from the graphical user interface. The system shall be equipped with diagnostics logging capability.
6. The system shall provide the capability of assigning speaker locations to any one or more software programmable zones for zone paging. The number of zones allowed shall not be limited.
7. Systems amplifiers shall be capable of providing sufficient power for emergency paging of all speakers with a 30 percent reserved capacity for future expansion.
8. System central control equipment shall be Underwriters Laboratory listed under Commercial Audio Systems and Accessories UL 813 and installed in a 19" rack cabinet and located where shown on the drawings or as directed by the Architect.
9. Provide an Uninterruptible Power Supply (UPS) with sufficient standby battery capacity to operate the intercom/paging system without AC power for two hours of normal operation (no announcements) and thirty minutes of all-call announcement operation (full load) at the end of this period.

10. The work described by this section includes the furnishing of all components, materials, equipment, installation and technical labor and the performance of all operations necessary for the complete installation of an Intercom - Clock System in operating condition as indicated on the drawings and/or specified herein including:
    a. Licenses, permits as may be applicable
    b. Provision of submittal information
    c. Installation in accordance with contract documents, manufacturers' recommendations and applicable codes
    d. Configuration of control and signal software including custom programming if required Testing and adjustments, including documentation thereof
    e. Provision of manuals
    f. Maintenance and warranty services

2.5 AUDIO PROGRAM SOURCE

A. AM/FM Tuner/CD or equivalent to connect via 3.5 to 3.5 mm patch cable to the Master CM3000 network controller.

2.6 TELEPHONE SYSTEM INTERFACE FUNCTIONS

A. The functions described below are accomplished through the connection of the paging system to a Universal Telephone Interface (kit # CMP-500) to the building telephone system through a dedicated land line to allow telephone to access to this port.

B. In order for these functions to operate, the Owner must provide a dedicated telephone line.

C. Any system telephone shall be able to page on an all-call, and zone basis to any of the programmed paging zones.

D. Any administrative system telephone shall be able to initiate an emergency announcement to all locations. Emergency announcements override all other programs.

E. Any system telephone shall be able to initiate emergency evacuation voice announcements and/or pre-recorded emergency tones and signals.

2.7 MASTER CLOCK SYSTEM

A. The master clock system shall include an easy-to-use web-based interface that allows for configuration via the Internet or LAN/WAN and Internet NTP / UTC World Time Clock Synchronization.

B. Clocks shall be placed at rear wall of classrooms and other rooms as required, per each campus design – Sapling #SAP-4BS-12R-0-A1 (12” round, black plastic case, standard 12-hour face).

C. Internet UTC World Time Clock Synchronization: Provide World Time Clock Synchronization for the master clock system. Contractor must program Conductor’s time source to the same internet UTC.

D. Provide one (1) PoE yellow CAT6A UTP to each clock (for power and time signal) from Owner provided PoE network switches at MDF/IDF’s.

E. Load Sapling clock software on FrontRow Admin Station computer/display for clock control.

2.8 INTERCOM SYSTEM HEADEND EQUIPMENT

A. Mount all equipment, except portable equipment, firmly in place. Permanently mark all cables and install in a professional, neat, and orderly installation. All wiring and cables will be securely fastened and routed using wire ties. Provide for adequate ventilation in all equipment racks and take precautions to prevent electromagnetic or electrostatic hum. Insert test results in the owner's manual.

B. Provide the components necessary to form a complete integrated system performing to the above specifications. FrontRow Conductor IP Intercom System as herein listed or a pre-submitted and approved equivalent meeting all requirements of the plans and specifications.

C. The intercom shall contain all internal components to allow connection of 30% spare intercom circuits. Equipment list, quantities as required, shall consist of but not limited to:
   1. FrontRow DRS5000 Rack Mount Server (1RU) running:
      a. FrontRow Conductor software database
      b. FrontRow Maestro asset management software
      c. FrontRow Encore software management
      d. FrontRow Time Sync Software

D. FrontRow CMP-500 Universal Telephone Interface

E. Inputs and Balanced/Unbalanced Output

F. Uninterruptible power supply (included with #FR-ADMN)

G. The parts described above for the FrontRow Admin Station are classified in the following kits:
   1. #FR-ADMIN: Includes complete office station for Conductor communications. It consists of all-in-one touch PC with preloaded software; CM3000 master controller; CB65 microphone; UPS battery backup; wireless keyboard & mouse; mousepad; printed user guide; one audio to USB adapter.
   2. #DRS-5000: 1U Linux based server with power supply. It includes license for Maestro network management software; Encore licensing and updating service; FrontRow control panel Timesync service and one Flashback USB drive.

2.9 FAST ETHERNET PoE SWITCHES FOR INTERCOM ANNOUNCEMENT AND AUDIO INTERFACE / AMPLIFIER NETWORK CONNECTIVITY

A. A classroom battery backup system PD-20W POE is required to ensure that the paging/intercom system stays active during a power outage (refer to section 27-41-__ Integrated Audio-Video Systems). For non-classroom paging areas, the network switch must provide a minimum POE standard of 802.3af for each PD-20W device. In addition, all relevant network switches, routers, etc. must be supported by a local UPS.

2.10 ADMINISTRATOR STATION

A. Provide all parts necessary for the correct performance of the FrontRow head end system #FR-ADMIN.

2.11 INTERCOM ANNOUNCEMENT AUDIO INTERFACES/AMPLIFIERS:

A. Classrooms: refer to section 27-61-00 Integrated Audio-Video Systems

B. Classroom Call Buttons: Provide intercom call buttons #CB-75 as indicated on plans. Call buttons shall be a single switch designated "PUSH TO CALL" on a single gang stainless steel or high-impact plastic wall plate. Color of device wall plate to be off-white, ivory, etc. to best match project light switches and electrical outlets, coordinate with the Electric Contractor –

C. Offices, corridors, and common areas with one to four speakers – Provide as required.

D. FrontRow CM-800S audio decoder/controller/32W amplifiers, each with a FrontRow PD-20W PoE power extractor, and 8-ohm speakers, quantity as indicated on plans and types as follows:

1. In rooms (other than classrooms) with lay-in ceilings provide 2’ X 2’ lay-in flush ceiling speakers - Quam-Nichols Company SYSTEM 5/8 or equivalent shallow depth, lightweight loudspeaker assembly with an 8” O.D. 8-Ohm loudspeaker with concentric mount hard fiber HF cone, perforated steel grill and integral molded 617 CID fiber enclosure. Cable clamp is included; three (3) seismic tie-off points, one 24" "T" bar to finish edge. Grille with a white baked epoxy hybrid finish. Each speaker assembly shall feature a 1' x 2' drop-in white metal mesh panel grille and be supported by wire from the building structure; in no case shall the ceiling grid solely support these assemblies.
2. In rooms with open or hard ceilings provide 8” speakers with round grille and back box - Quam-Nichols Company 8C10CO 8" O.D. coaxial loudspeaker with a piezo tweeter, 10 oz. magnet, and an 8 Ohm nominal impedance with a BR8WS 22-gauge white, round, steel, stud mount baffle, and ERD8U - 275 CID 16-gauge steel round back box.
3. In high ceiling areas requiring wall mount speakers - TOA model H-1 two-way, sealed enclosure with a minimum reflection design that can be rotated to aim the loudspeaker without altering the external appearance. Each speaker shall feature a white grille, 1" Ferro-fluid-cooled dome tweeter, 3" x 2" cone Neodymium woofer, and 8-ohm and 25/70-volt matching transformer inputs.
4. Horn speakers shall be Quam H16/RVP with Quam ES-8 exterior 1 backbox or Quam SE2WVP interior back box.

E. COMMON AREA AND OUTDOOR ZONE AMPLIFIERS: Atlas Sound, single channel, 70V amplifiers (PA1001G, PA60G, PA40G) shall be provided for the following zoned areas. Provide a dedicated amplifier for each zone listed. Size amplifiers as required to accommodate 125% of the speakers connected to the amplifier:

1. Cafeteria
2. Library (partial)
3. Admin Corridors
4. General corridors
5. Kitchen
6. Gymnasium
7. Exterior

2.12 CABLE

A. The Contractor shall provide and install new and unused ASTM bare solid copper conductor wire per ANSI/NEMA codes. Follow the manufacturer's instructions. All wire shall be UL listed for communication and control circuits.

B. All cable shall have labels on both ends utilizing self-laminating, flexible vinyl film and non11 smear nylon marking pens. Utilize Tyton Corporation Part No. RO175 Rite-On labels and

Part No. FTP1 nylon marking pens or equivalent.

C. Each call button shall be wired with Category 5e cable.

D. Each speaker cable shall be NEC type CMR, West Penn Wire No. 291, 22 AWG, overall shielded, two (2) conductor, plus one (1) drain wire. Equivalent by Belden, Carol, or Comtran.

2.13 CABLE TIES

A. Nylon cable ties shall be furnished and installed to attach wire bundles to supports and for appropriate wire management as required.
1. Nylon wire tie, 3.9”, miniature - Panduit PLT1M-C or equivalent.
2. Nylon wire tie, 5.6”, miniature - Panduit PLT1.5M-C or equivalent.
3. Nylon wire tie, 11.4”, intermediate - Panduit PLT3I-C or equivalent.
4. Nylon wire tie, 14.6”, intermediate - Panduit PLT4I-C or equivalent.

2.14 CABLE ROUTING, INSTALLATION, AND SUPPORT

A. System wiring and equipment installation shall be in accordance with good engineering practices as established by the NEC and the TIA/EIA. Wiring shall meet all state and local electrical code requirements.

B. Cable pathways, conduit, and cable support systems shall be complete with bushings, deburred, cleaned, and secure prior to installation of cable.

C. All wiring shall test free from opens, grounds, or shorts. All communication cable shall be supported from the building structure and bundled. Do not attach any supports to joist bridging or other lightweight members.

D. The support system shall provide a protective pathway 1 to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

E. In all exposed areas such as gymnasiums, shops, field houses, janitors’ closets, or mechanical / electrical rooms all communication cable shall be fully enclosed in conduit.

F. Communication cables shall be run in trays from wall boxes to accessible area above finished ceilings. Conduit shall be required only within walls and concealed spaces to provide access.

G. Provide bushings to protect the cable from damage for conduit ends, box openings, and passage through metal studs.

H. Communication cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with cable ties randomly spaced at 30 to 48 inches on center, cable ties shall not be tight enough to deform cabling and shall not be used to support the cabling.

I. Communication cable must not be fastened to electrical conduits, mechanical ductwork/piping; sprinkler pipes, or routed to obstruct access to hatches, doors, utility access panels, or service work areas. Do not route cables through fire doors, ventilation shafts, grates, or parallel for more than four (4) feet with line voltage electrical conductors.

Communication cables shall not be run loose on ceiling grid or ceiling tiles.

J. Support shall be provided by mounting appropriate fasteners that may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. The cable pathway of supports must be positioned at least 12 inches above the ceiling grid.

K. All cabling shall be placed with regard to the environment, EMI/RFI interference, and its effect on communication signal transmission.

L. Do not route any data communication cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

M. Communication cable will not be installed in the same conduit, raceway, tray, duct, or track with line voltage electrical cable without a metallic barrier meeting NEC requirement.

N. Maximum cable pulling tension should not exceed 25 lb./ft. or manufactures recommendation, whichever is less.

O. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

P. No terminations or splices shall be installed in or above ceilings.

Q. Cable bends shall not be tighter that the manufacturers' suggested bend radius.

R. Mount all equipment firmly in place such that vibration or jarring will not activate an alarm, supervisory, or trouble signal. Route cable in a professional, neat, and orderly installation.

S. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation Part number RO175 Rite-On labels and Part number FTP1 nylon marking pens or equivalent.

T. Each cable run shall include a three-foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.

U. Provide for adequate ventilation to all equipment racks and take precautions to prevent electromagnetic or electrostatic hum.

V. All conduit, ducts, track, and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices. Cable fill may not exceed the manufacturers' instructions for each type of support.

W. Devices mounted on a drop ceiling shall feature a backbox fitted with a support hanger (Caddy #512 or #512A for deep boxes), or equivalent with independent drop wires to support the weight of the device.

2.15 TERMINATION PRACTICES

A. Strip back only as much cable jacket as required to terminate.

B. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.

C. Avoid twisting cable jacket during installation.

2.16 BUSHINGS

A. Provide a plastic snap in bushing at each box opening, passage through a metal stud, and at the end of all open conduit stubs or sleeves prior to cable installation to protect the cabling from damage:
1. Box openings - Thomas & Betts Knockout Bushing Series 3210, or equivalent.
2. Metal stud passage - Thomas & Betts Twist It Bushing Catalog Number SB1216-SC, or equivalent.
3. Conduit ends - Thomas & Betts Anti-Short Bushing Series 390 or Tite-Bite Combination couplings Series 442, or equivalent.

2.17 J-HOOKS

A. Attachments for cabling support shall be spaced at approximately 48 to 60 inches on center.

B. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:
1. Single cables or bundles up to four cables may be supported directly by the building structure.
2. Bundles up to 1/2" dia. (Ten 1/4" cables) 2" bridle ring, Caddy #4BRT32 or equivalent.
3. Bundles up to 3/4" dia. (Sixteen 1/4" cables) 3/4" J-Hook, Caddy #CAT12 or equivalent.
4. Bundles up to 1-5/16" dia. (Fifty 1/4" cables) 1-5/16" J-Hook, Caddy #CAT21 or equivalent.
5. Bundles up to 2" dia. (Eighty 1/4" cables) 2" J-Hook, 1 Caddy #CAT32 or equivalent.
6. Split bundles greater than 2" dia. or provide cable tray.

C. Do not mix different signal strength cables on the same J-Hook (i.e. intercom with telephone/data cable). Multiple J-Hooks can be placed on the same attachment point, up to the rated weight load of the attachment device.

2.18 SURGE AND AMPERAGE PROTECTION

A. Electrical surge protection shall be provided for all service entrance connections and on each copper pair that connects one building to another (i.e. any other portion of a building complex not under one continuous roof) at both exit points to prevent damage to equipment.

2.19 FIRE STOPPING, DRAFT/NOISE STOPPING, PENETRATIONS, AND CORING

A. UL Listed fire stopping methods that match the fire rating of the wall or floor being penetrated are to be used at all fire barrier penetrations. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, install according to the manufacturers' instructions.

B. All penetrations through fire rated walls or floors shall feature a suitable length of metal conduit. Hole diameter shall not exceed ½" larger than the conduit or sleeve to be installed. The hole shall be neatly cut, not oversize or irregular. Do not share wall/floor penetrations

with ductwork, piping, line voltage electrical conduits, etc.

C. All gypsum board or plaster penetrations shall tool cut using an appropriate hole saw / mandrel or manufactured assembly.

D. Draft/Noise Stopping - All penetrations through non-rated walls shall include draft/noise stopping to minimize the transfer of air and sound between enclosed areas. This shall include but not limited to:
1. Neatly cutting all non-rated wall penetrations with a 1" maximum clearance. All gypsum board or plaster penetrations shall be tool cut using an appropriate hole saw / mandrel or manufactured assembly. The hole shall be neatly cut and not oversize or irregular. Do not share wall penetrations with other types of ductwork, piping, line voltage electrical conduits, communications cabling, etc.
2. Provide and install non-combustible mineral wool, fiberglass, cellulose insulation, caulk, and/or sealant as required. Seal the interior of conduit sleeves around the cables and around the outside of the sleeve on each side of the penetration with caulk or putty, install materials according to the manufacturers' instructions.

E. The Contractor shall make every effort to coordinate with the building Architect, Engineer, Builder, and Electrical Contractor to have sleeves placed in new construction so that later coring or drilling of building structural members will not be required. 1 The Contractor must consult with the building Architect, Engineer, and Builder prior to drilling, coring, or sawing of any wall, floor, etc. All penetrations shall be made at approved, appropriate, locations.

F. Upon approval, the Contractor shall be required to supply all labor, equipment, tools, and materials to create any additional penetrations, and shall provide the sleeve, temporary and final fire stopping. Special care shall be taken not to stress, overheat, or penetrate any building support member. Coring shall be made with equipment appropriate for the dry penetration of concrete and block materials. Under no circumstances shall penetrations be made utilizing a chisel or percussion type equipment. Concrete, block, or plaster cores shall be made by dry saw/core methods only.

PART 3 - EXECUTION

3.1 OCCUPANCY ADJUSTMENTS

A. On-Site Assistance: Engage a factory-authorized service representative to provide on-site assistance in adjusting sound levels, resetting transformer taps, and adjusting controls to meet occupancy conditions. Provide up to three on-site assistance visits within one year of Substantial Completion.

3.2 TESTING, CERTIFICATION, WARRANTY, SERVICE

A. A factory trained service technician shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect, Engineer, and local authorities. Testing shall insure the following:
1. Before energizing the cables and wires, check for correct connections and test for short-circuits, ground faults, continuity, and insulation.
2. Complete and functional system.
3. Installed in accordance with manufacturer's instructions.
4. Upon completion of the testing, the manufacturer or his representative shall issue to the Owner a letter of certification attesting to the fact that he has tested and adjusted the system, that all components are properly installed and free of defects, and that

the system is in compliance with this specification.

B. The contractor shall provide a warranty and service contract for the installed system. The warranty shall be against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment or wiring shown to be defective shall be replaced, repaired, or adjusted free of charge. All labor and materials shall be provided at no expense to the Owner. All equipment will carry a one-year warranty or manufacturer's warranty whichever is greater.

C. The service contract shall provide a minimum of the following:
1. Diagnostics of the system should a problem occur.
2. Reprogramming - Desired changes to class of service of any device or to the bell schedule. The Intercom Communications System Contractor will provide this service with an unlimited number or frequency of the changes.
3. The Communication Systems Contractor will provide service software upgrades to the system that become effective during the period of the service contract.

D. The contractor shall make available a service contract offering continuing factory authorized service of this system after the initial warranty period. This contract shall automatically renew each year at the owner's discretion. Contractor will provide the cost of renewal 1 to the owner thirty (30) days prior to the expiration of the contract after the first year.

E. The system manufacturer shall maintain engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.

3.3 DRAWINGS, MANUALS, AND TRAINING

A. In addition, the contractor shall furnish complete operating and maintenance manuals listing the manufacturer's name(s), including technical data sheets. Manuals shall include wiring diagrams to indicate internal wiring for each device and the interconnections between the items of equipment. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system. Provide a parts list with manufacturer and model number for commonly replaced parts. Include complete instructions for the inspection, testing, and maintenance of the system. Include copies of all programming sheets used to configure the system.

B. The Contractor shall conduct formal on-site training sessions. Provide documented general instruction as follows:
1. Provide instruction to the maintenance personnel to include the location, inspection, maintenance, testing, and operation of all system components. Provide a minimum of four (4) hours--two 2-hour sessions separated by a minimum of two weeks.
2. Provide instruction to designated personnel on the functions and operation of the intercom and master clock system including emergency and service request procedures. Provide a minimum of four (4) hours--two 2-hour sessions separated by a minimum of two weeks.

END SECTION 27 51 23

SECTION 27 51 24 LOCAL SOUND DISTRIBUTION SYSTEM

PART 1 – GENERAL

1.1 RELATED WORK

A. The following sections shall associate with this specification as applicable.
1. General Conditions
2. Supplementary Conditions
3. Division 1
4. Division 26 in its entirety.
5. Division 27 in its entirety.
6. Division 28 in its entirety.

1.2 GENERAL REQUIREMENTS

A. Provide all equipment specified well as all miscellaneous parts and materials required for the proper, complete, and functional Local Sound Distribution System at the following Venues:
1. Gymnasium
2. Dining

B. System shall be a single system that can be combined or divided by space, with controllable inputs, outputs, and microphones.

C. System shall integrate sound from projector.

D. All applicable equipment shall bear the UL label.

E. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

F. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the owner.

G. Plenum rated cable may be used as an option at the contractor's discretion. Wherever cabling is run exposed, conduit shall be used to cover and protect wiring.

H. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

1.3 CONTRACTOR QUALIFICATIONS

A. The installing contractor shall be the authorized representative of the local sound distribution system to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the manufacturer's product for at least

four (4) years.

B. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.

C. The installing contractor must have a permanent office within a 75-mile radius of the project site and be an approved dealer/integrator, of the proposed system, in the nearest major metropolitan area.

D. The installing contractor shall have been actively engaged in the business of selling, installing, and servicing systems in the surrounding area for at least ten (10) years.

E. All individuals installing the local sound distribution system must be employees of the proposing/installing entity and at least 25% of the installing staff shall have undergone a training class covering the installation and programming of local sound distribution systems. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.

F. The entity providing pricing to furnish and install the system specified within this specification section and the physical installing entity of this system shall be one in the same. Absolutely no subcontracting on any portion of this system, by the system's proposing entity, will be allowed.

G. Acceptable manufacturers:
1. Reference Part 2 of this specification for manufactures as specified. No other manufacturers will be accepted without submitting a formal request within no less than ten (10) day prior to the proposal date and if not officially approved via pre-proposal addendum.

1.4 SUBMITTALS

A. Product Data:
1. Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
a. Product Literature: Complete manufacturer's product literature for all cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be provided
b. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
c. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
d. Certifications: The contractor shall submit all of the following

certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.

1) Manufacturer's Authorized Dealer/Installer Certification as they apply to any portion of this specification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is an authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
2) Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant. At least one individual employed by the installing firm shall have a CTS or higher certification.

B. Shop Drawings:

1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
   a. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
   b. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
      1) Location of all control equipment and remote power sources
      2) Locations of all field devices and outlets
      3) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
      4) Location of sleeved wall pass-thru
      5) Size of sleeve at each location installed
      6) Quantity of cable passing through each sleeve
      7) Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)
      8) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.
      9) An "As Built" block diagram of the system showing how the components are connected and where each is located.
      10) Wiring diagram for equipment including point-to-point circuit diagrams.
      11) Color code of conductors.
   c. Drawing Compliance: A letter shall be provided stating that the system installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.

C. Close-out Procedures:

1. Four (4) copies of the following documents shall be delivered to the

Architect/Engineer at the time of system acceptance. One (1) final copy of the same documents shall be delivered directly to the project's Technology Consultant upon final closeout of the project. The closeout submittals shall include:

a. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
b. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
c. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
d. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
e. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
f. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the structure cabling system from the original approved shop drawings. Drawings shall consist of a scaled plan of each building showing the placement of each individual item of the technical cabling system equipment as well as raceway size and routing, junction boxes, and conductor size, quantity, and color in each raceway.
g. As-built Drawings shall include cable pathways, device locations with correct labeling, field device locations, and head end locations.
h. In addition, As-built drawings shall consist of the following:
    1) An "As Built" block diagram of the system showing how the components are connected and where each is located.
    2) Wiring diagram for equipment including point-to-point circuit diagrams.
    3) Color code of conductors.
i. The as-built drawings shall be prepared using AutoCad 2015 or later. Provide the Owner with electronic versions of the as-builts on CD media and (1) hard copy per binder.
j. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
k. A copy of the manufacturer's warranty on the installed system.
l. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
m. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)
n. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Minimum amount of training time shall be at least 8 hours and shall be broken up into two (2) hour sessions. Provide copies

o. One (1) 30” x 42” laminated as-built floor plan and schematic detail drawing shall placed inside the head end cabinet.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The following manufacturers are listed within this specification. All products specified and associated with a specific manufacturer are to be provided as specified, no exceptions.
1. Q-SYS
2. Listen.

2.2 SOUND SYSTEMS COMPONENTS AND EQUIPMENT – ALL VENUES

A. Custom Plates
1. Liberty Panel Crafters, Proco, or RCI are approved manufacturers.
2. Provide custom plates as indicated on the drawings.
3. Engrave outlet with device number for all wall mounted outlets.

. B. Processor
1. Approved Products
a. Q-SYS Unified Core Processor

C. Amplifier
1. Approved Products
a. Q-SYS CX-Q Series
b. Minimum (4) channels
c/ Minimum 1000W power per channel @ 8Ω

C. Mic/Aux/Bluetooth Mixer Interface
1. Approved Products
a. Aux/Bluetooth Mixer: Octasound RABX2
b. Aux/Mic Mixer: Octasound RAMX2
c. Provide recessed enclosure with locking door
d. Mount at +42” AFF.

D. Control Panel
1. Approved Products
a. Q-SYS TSC-101-G3

D. Miscellaneous Equipment
1. Provide the following equipment for the overall combined venue.
a. (2) Shure SM58S-LC Microphones
b. (1) 25’ Microphone cable
c. (1) 50’ Microphone cable
d. (2) Atlas MS20E Mic Stand
e. (1) Atlas TL34-15E Boom Stand
f. At locations with associated projectors, provide one (1) Radio Design Labs TX-J2 for projector audio interface.

E. ASSISTED LISTENING: Provide a remote antenna. Adjust DSP for “hard knee” compression on assisted listening output. Test and use equalization for maximum sound quality.
1. Listen LT-800-72-1-14-3 – Assistive Listening with rack mount kit
2. Listen LR-500-72-0-M-A-A FM Receiver

3. Listen LA-166 Neck Loop
4. Listen LA-324 Charging/Carrying Case
5. Provide quantities needed to fulfill the quantities stipulated in the Receivers for Assistive Listening Systems Table.
6. Acceptable Equivalent:
   a. Williams Sound

RECEIVERS FOR ASSISTIVE LISTENING SYSTEMS TABLE

Capacity of Seating in Assembly Area	Minimum Number of Required Receivers	Minimum Number of Required Receivers Required to be Hearing-aid Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats	2
201 to 500	2, plus 1 per 25 seats over 50 seats	1 per 4 receivers
501 to 1000	20, plus 1 per 33 seats over 500 seats	1 per 4 receivers
1001 to 2000	35, plus 1 per 50 seats over 1000 seats	1 per 4 receivers
2001 and over	55, plus 1 per 100 seats over 2000 seats	1 per 4 receivers

2.3 SOUND SYSTEMS COMPONENTS AND EQUIPMENT – VENUE SPECIFIC

A. Gymnasium/Stage
   1. Speakers
      a. Provide and install sound reinforcement loudspeakers and subwoofers, with all required rigging hardware. Installer shall size speaker configuration as required to obtain a minimum of 100 dB SPL to the entire listening area.
         1) Loudspeaker: QSC K8.2 Powered Speakers. Provide quantity as shown on drawings.
         2) Mount: QSC K8.2 Yoke
   2. Wireless Microphone System – Provide the following:
      a. Approved Products – Shure
      b. Digital Wireless Receiver, Product No. QLXD4 (qty of 2)
      c. Handheld Transmitter with SM58, Product No. QLXD2/SM58 (qty of 2)
      d. Bodypack Transmitter, Product No. QLXD1 (qty of 2)
      h. Headset Microphone, Product No. SM35 (qty of 2)
      d. Shure UA844SWB antenna combiner/power supply. (Qty 1)
      e. Shure UA8-470-530 (for band G) 1/2 Wave Antennas. (Qty as shown on drawings)
   3. Rack Mounted Equipment
      a. 10-Channel Rackmount Mixer with Bluetooth Wireless, Alesis Multimix 10 Wireless (qty of 1)
      b. Digital Signal Processor (DSP), BSS Blu-50 (qty of 1)
      c. Power Conditioner, Atlas AP-S15LA
      d. Power Sequencer, Atlas ECS-3 (qty of 1)
      e. Portable Audio Interface Panel, ProCo iRACK
      f. Custom Dual System Combine Switch Panel
   4. Equipment Rack
      1. Provide and install equipment rack at locations designated on the contract drawings. Equipment rack shall consist of the following:
         a. Equipment Rack, Atlas 221-18
         b. Accessories
            i. Roller Truck Assembly, Atlas CT-1020
            ii. Provide blank panels necessary to enclose rack

completely

B. Cafeteria
1. Speakers
a. Provide and install sound reinforcement loudspeakers and subwoofers, with all required rigging hardware. Installer shall size speaker configuration as required to obtain a minimum of 100 dB SPL to the entire listening area.
1) Loudspeaker: QSC K8.2 Powered Speakers. Provide quantity as shown on drawings.
2) Mount: QSC K8.2 Yoke
2. Wireless Microphone System – Provide the following:
a. Approved Products – Shure
b. Digital Wireless Receiver, Product No. QLXD4 (qty of 1)
c. Handheld Transmitter with SM58, Product No. QLXD2/SM58 (qty of 1)
d. Bodypack Transmitter, Product No. QLXD1 (qty of 1)
h. Headset Microphone, Product No. SM35 (qty of 2)
e. Shure UA8-470-530 (for band G) 1/2 Wave Antennas. (Qty as shown on drawings)
3. Rack Mounted Equipment
a. 4-channel Rackmount Microphone Mixer, Shure SCM268 (qty of 1)
c. Power Conditioner, Atlas AP-S15LA (qty of 1)
e. Portable Audio Interface Panel, ProCo iRACK
4. Equipment Rack
1. Provide and install equipment rack at locations designated on the contract drawings. Equipment rack shall consist of the following:
a. Equipment Rack, Atlas AWR-3W
b. Accessories
i. Provide blank panels necessary to enclose rack completely

2.4 WIRING

A. All system wiring shall be provided as specified, unless required differently by the manufacturer's instruction and/or governing codes and local authorities.
1. Microphone Wiring – 22ga shielded – with PVC jacket when installed in conduit
2. Speaker wiring for Gymnasium Low Frequency speakers - #10 THHN Full Range Speakers to be #12THHN
3. Wireless Mic Coax – Provide RG-58 Coaxial Cable, minimum. (reference manufacturer installation instructions for proper cable required for a complete and functional system)
4. Network connection and BLU Link – Provide CAT6 cable
5. Cables, wiring, and interconnect terminal strips to be logically, legibly, and indelibly labeled for immediate identification by a direct hot-stamp method or a factory stamped closed sleeve method as approved. Adhesive strip labels are acceptable only if sealed with transparent heat-shrinkable tubing to hold the marker in its position. Provide all wiring labeling information on schematic diagram in project record drawings. Labeling equal to Brady PM-1M "Porta Mark", T&B heatshrink markers, or approved equal.
6. Cabling
a. Approved Products – Liberty Cable 22-IP-EZ-Color line level
b. Approved Products – Liberty Cable 22-IP-EZ-Color microphone level
c. Approved Products – Liberty Cable 22-IP-EZ-Color control
d. Approved Products – Liberty Cable 12-2C-Color speaker level
e. May substitute with West Penn or Belden if plenum colors are available

f. Label all wiring with permanent means, using printer generated labels.

2.5 INSPECTIONS

A. General: Conformance to the installation practices covered above are to be verified when completed. In some cases, the Owner/ Designer may inspect before acceptance.

2.6 SOUND COVERAGE

A. Adjust speaker wattage taps to provide clear, uniform sound coverage, throughout each venue, through entire volume range of amplifier. Provide limiter circuit and controls on amplifier to prevent over-driving speaker system.
B. Contractor shall provide additional speakers, if required, to provide a 25% coverage overlap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide and install Sound Reinforcement System in Dining and Gymnasium as required. All rack mounted equipment and their controls shall be labeled with 1/4” lamicoid strips engraved with 1/8” high block letters indicating device operation and level of control function. Verify exact location of equipment racks and remote source control panel with Architect prior to rough-in.

B. Coordinate final connection of power and ground wiring to equipment racks. Power and ground wiring shall terminate inside equipment racks and be hard wired directly to ground busses to ensure uninterrupted operation.

C. All equipment and enclosures described in this specification shall be permanently attached to the structure and held firmly in place. Supports shall be adequate to support their loads with a safety factor of at least 3X the weight of the equipment or enclosure.

D. The process of equalizing and testing the Audio Sound System may necessitate moving and adjusting certain component parts (ex. loudspeakers). This shall be done at no additional cost to the owner.

E. Take precautions as necessary to prevent and guard against electromagnetic and electrostatic noise interference.

F. Locate wireless microphone system antennas and hearing assist system antennas at or above ceiling or at bar joist height in areas without ceilings. Coordinate exact location with owner. Provide adequate protective guards. Adjust antenna location for best possible reception/transmission in area of coverage.

G. Provide hearing assist transmitter(s) and receivers for each sound reinforcement system. The quantity of hearing assist receivers for each system shall be equal to a minimum of four (4) percent of the total seating capacity, but in no case less than ten (4) receivers for the area of coverage of each local sound reinforcement system.

H. Connect projector sound output to local sound system; program as output option on control panel

I. System shall have the capability of combining and dividing Cafeteria/Gym spaces.

3.2 CABLE

A. GENERAL
1. Single system cables may be grouped together in a common conduit or cable support of adequate capacity to facilitate the ease of installation and prevent conductor or insulation damage.
2. Do not group conductors or cables of different systems in one common conduit or cable supports.
3. Install cables as recommended by the system manufacturer. Conductor quantities specified are minimum required. Conductors to be installed shall be coordinated with the system equipment supplier. Cables installed on exposed surfaces, in inaccessible locations, or underground shall be in conduit.
4. Cables installed above accessible ceiling spaces, may be installed without conduit. All cables not installed in conduit shall be plenum rated. Install cables that are not available with a plenum rating in conduit.
5. Cables installed in hollow wall spaces shall be installed in conduit to an accessible location.
6. Tag each circuit at each end and at each terminal with a separate tag indicating area served.
7. Color code wire in accordance with IPCEA standards.
8. Terminate speaker cables in junction box.
9. All local sound distribution system cable on the entire project shall be white in color.

B. Coordinate final connection of power and ground wiring to equipment racks. Power and ground wiring shall terminate inside equipment racks and be hard wired directly to ground busses to ensure uninterrupted operation.

C. Take precautions as necessary to prevent and guard against electromagnetic and electrostatic noise interference.

D. Exercise care in wiring to avoid damage to the cables and to the equipment. Isolate cables carrying signals at different levels and separate to restrict channel bleed-through the feedback oscillation in any amplifier section. Connect all loudspeakers electrically in phase, using the same wire color code for speaker wiring throughout the project. Make all joints and connections with resin core solder or with approved mechanical connectors. Install three conductors individually wired ground 120 VAC stripline in each rack.

E. Keep wiring separated into four groups of conduit for microphone level circuits (level below -20dBm), line level circuits (up to +30dBm), loud speaker circuits (above +30 dBm), and power circuits.

3.3 CABLE PATHWAYS

A. Cable Support:
1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops. Each support shall be sized appropriately for the number of wires being installed. Reference the manufacturer’s specifications for the suggested maximum cables per support size.
a. Approved Cable Support Product:
PANDUIT® Corporation
Caddy
B-Line

Arlington Manufacturing, or
Preapproved equivalent

2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5’ of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5’ of the finished ceiling and mount the cable support to the treaded rod.
3. Cable supports shall be installed at a maximum of 5’ on center.
4. All cable installed shall be attached, to the cable support system, with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run.
5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building’s steel or supported in any other method than that stated above.
6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
7. Do not route cable through webbing of structural steel.

B. Conduit / Raceway:
1. Conduit shall be provided for all cabling routing across open ceiling spaces and/or through, non-accessible, solid ceiling spaces.
2. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
3. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
4. Minimum conduit size shall be a minimum 3/4" EMT. Install conduit per engineered shop drawings.
5. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
6. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

3.4 TESTING AND ACCEPTANCE

A. General
1. After completion of installation and start up procedures, commence a verification and testing sequence leading to final acceptance of the owner.
2. Submit for approval, a sample of the form on which the test will be reported.
   a. Identify project
   b. Signatures of participants and observers
   c. Results
   d. Description of adjustment or corrections of defective components.
   e. Date
3. Provide schedule of tests. Estimate dates of significant events.
   f. All testing shall be performed in the presence of the Owner/Architect/Engineer.
4. Test, calibrate and adjust each device in the system
5. Verify operation of all specified functions.
6. Provide documentation of all tests and verifications as specified.

B. The following tests and adjustments shall be performed by the Contractor. All equipment required supplied by the Contractor. Follow EIA standards RS-160 and RS-219 in performing tests. Record the results of these tests on project record drawings. Submit written results of tests to Architect prior to scheduled equalization and final inspection date.

1. Measure and record impedance of each speaker line terminating at equipment racks at frequency of 1,000 Hz. with loudspeakers connected to their respective lines.
2. Check system to ensure freedom from oscillations or stray RF pickup. Check inputs with no signal and with typical program material driving system to full output. Detect unwanted signals.

3.5 INSTRUCTIONS

A. Provide 2 hours, 1 hour on each of two days, of instruction to the Owner designated user and maintenance personnel on the use and operation of the system. Instructing personnel shall be a competent engineer or technician familiar with the installed system. Instruction times shall be arranged by the Owner.

3.6 ACCEPTANCE BY OWNER

A. Upon completion of initial tests and delivery of all documents, diagrams, and project record drawings, notify the Architect in writing that the installation has been completed in accordance with the requirements of the specification and is ready for equalization and inspection by representatives of the Owner.

B. Acceptance testing will include operation by the Owner of each major system and other components (microphones, consoles, racks, loudspeakers, etc.) deemed necessary. Contractor will assist as necessary in this testing.

C. In the event the need for further adjustments or work becomes evident during acceptance testing, the Contractor will continue his work until the system is acceptable, at no additional cost to the Owner.

3.7 EXTRA WARRANTY PROVISIONS

A. Labor and materials provided under this section shall be warranted for not less than one (1) year after final acceptance of the work by the Owner. Defects occurring in labor or materials within the one-year warranty are to be rectified by replacement or repair. This contractor, within the warranty period, is required to answer all service calls and requests for information within a 24-hour period and repair or replace any faulty items within a 24-hour period, without charge, including parts and labor.

END OF SECTION 27 51 24

SECTION 27 61 00 **INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR INSTRUCTIONAL SPACES**

PART 1 - GENERAL

1.1 RELATED WORK

The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.

A. Conditions of the Contract
B. Division 1
C. Division 26
D. Division 27
E. Division 28

1.2 SUMMARY

A. Section Includes:
1. Stand-alone, networkable, scalable, one-room AV control and presentation system with user control panel and software.

B. The drawings and specifications are to be considered conceptual in nature and are intended to establish system standards insofar as manufacturer type and system configuration. The contractor shall provide pricing of a complete engineered system based on the issued conceptual documentation. The engineered system is to be submitted to the project's consultant for review prior to installation.

C. Classroom sound enhancement system shall serve as the classroom public announcement system, connected to the FrontRow Conductor system. Sound enhancement system shall be connected to network switch via data drop for POE, and shall be capable of switching to POE during a power failure to provide uninterrupted PA capabilities.

1.3 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Latest Local Codes and Amendments
2. National Electrical Code, current version

B. Other References:
1. ANSI/TIA/EIA-588-C.0 – General Cabling Standards
2. ANSI/TIA/EIA-568-C.1 -- Commercial Building Cabling Standard
3. ANSI/TIA/EIA-568-C.2 -- Balanced Twisted-Pair Cabling Standard
4. ANSI/BICSI 001-2009, Information Transport Systems Design Standard for K-12 5. Educational Institutions
6. ANSI S12.60:2002 Acoustic Performance Criteria, Design Requirements, Guidelines for Schools
7. ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling
8. ANSI/TIA/EIA-569-B -- Commercial Building Standard for Telecommunications Pathways and Spaces
9. ISO/IEC 18010:2002 (2002) – Pathways and Spaces for Customer Premises Cabling
10. ANSI/TIA/EIA-606(A) -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

11. ISO/IEC 14763-1:1999 (1999) – Implementation and Operation of Customer Premises Cabling, Part 1 – Administration
12. J-STD-607-A -- Commercial Building Grounding and Bonding Requirements for Telecommunications
13. IEEE 1100 – IEEE Emerald Book
14. NFPA 780 Standard for the Installation of Lightning Protection
15. Cal/OSHA-Pocket Guide for the Construction Industry (recent edition)
16. BICSI -- Telecommunications Distribution Methods Manual (TDMM)
17. BICSI -- Information Transport Systems Installation Methods Manual
18. BICSI - AV Design Reference Manual
19. BICSI – Network Design Reference Manual
20. Federal Communications Commission
21. Federal, state, and local codes, rules, regulations, and ordinances governing the work

C. Governing Codes and Conflicts:
1. If the requirements of these specifications or the Project Drawings exceed those of the governing codes and regulations, then the requirements of these specifications and the Drawings shall govern. However, nothing in the Drawings or Specifications shall be construed to permit work not conforming to all governing codes and regulations.

1.4 ABBREVIATIONS

A. The following abbreviations are some that are used this document and associated drawings:
1. PS: Audiovisual input station / Presentation Station
2. CMP: Ceiling Mounted Projector
3. LCD / FSD / LCD: Flat Screen Display / TV / Monitor
4. AV: Audio Visual.

1.5 CONFIGURATION

Contractor to provide and install the following configuration at all locations shown on the project drawings, with a minimum of one (1) system per instructional space.

A. A complete, networkable, scalable AV control, and presentation System. The AV equipment must be housed in lockable enclosures. System shall be FrontRow ezRoom Voice & Alert Trio System with Elevate presentation mics.

B. These Systems must include all equipment, cabling, materials, labor, and training as required to install and test a complete and operating System as described herein.

C. Contractor shall follow installation instructions provided by the manufacturer. Installation drawings shall show the location and general arrangement of equipment, electrical systems, and related items. They shall be followed as closely as elements of the construction will permit.

D. Contractor shall examine the installation drawings and verify the conditions governing the work on the job site. Contractor shall arrange accordingly, providing such fittings, horizontal cable raceways, conduits, junction boxes, and accessories as may be required to meet such conditions.

E. Deviations from the installation drawings, except minor changes in routing and other such incidental changes that do not affect the functioning or serviceability of the Systems, shall not be made without the written approval of the Engineer.

1.6 SUBMITTALS

A. Project Initiation:

1. Within fourteen (14) days of Notice to Proceed, the projection system installer shall furnish the following in a single consolidated submittal:
   a. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Architect/Engineer.
   b. Product Literature: Complete manufacturer's product literature for all, speakers, amplifiers, cable, cross-connect blocks, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation demonstrating compatibility with other related products shall be included.
   c. Construction Schedule: A time-scaled Construction Schedule, using PERT/CPM, indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
   d. Testing: Proposed Contractor test result forms, and a list of instrumentation to be used for systems testing.
   e. The contractor shall provide a letter from the manufacturer stating that the dealer is an authorized service center.
   f. The resume and contact information of the full time service personnel responsible for the installed projection system.
   g. Specification Compliance: A letter shall be provided stating, by section and subsection, that the installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
   h. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
      1) One (1) individual, employed by the installing firm, shall possess and maintain throughout the course of the project, an Avixa Certified Technology Specialist – Design (CTS-D) certification.
      2) One (1) individual, employed by the installing firm, shall possess and maintain, an Avixa Certified Technology Specialist – Installer (CTS-I) certification. This certified individual will be required to onsite during any installation, modification, testing, configuration, and/or programming of any portion of the AV system
         a) Provide specification with line by line acknowledgement of compliance.

B. Shop Drawings:
1. Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
   a. Proposed wiring and connectivity diagram of the proposed projection system including all faceplates and sound reinforcing equipment
   b. In addition to the wiring/connectivity diagram, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
      1) Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
      2) Location of sleeved wall pass-thru
      3) Size of sleeve at each location installed
      4) Quantity of cable passing through each sleeve
      5) Location of drops in each room (quantity or labeling of drops are not required in the submittal plans. Labeling shall be provided in the closeout

plans and quantities shall be as per the contract documents, addendums, and issued changes. Each drop shall be labeled for the type of outlet that it is)

6) Conduit routing, size, quantity, and stub-up locations for all floor mounted outlets.

c. Drawing Compliance: A letter shall be provided stating that the installer complies with the ENTIRE project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's Technology Consultant.

C. Project Completion:

1. As a condition for project acceptance, the Contractor shall submit the following for review and approval:

a. Samples: Complete manufacturer's product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.

b. Inspection and Test Reports: During the course of the project, the Contractor shall maintain an adequate inspection system to insure that the materials supplied and the work performed conform to Contract requirements. The contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.

c. Operating and Maintenance Instructions: Operating and maintenance instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction and shall be provided to the Owner for their use on disc or USB drive with the project name and description (2 copies).

d. Provide schematic line diagram of system components as deployed in each installation.

1.7 QUALITY ASSURANCE

A. The contractor providing and installing the integrated audiovisual systems and associated infrastructure shall be an authorized dealer of the specified projector manufacturer and be capable of providing the manufacturer's maximum available product warranty.

B. All individuals installing the audio-video system must be employees of the authorized dealer and at least 75% of the installing staff shall have undergone a training class given by the manufacturer. Current certification indicating the successful completion of the training course shall be available upon request at the project and submitted in the contractor's product submittals.

C. The proposing contractor and the installing contractor must be the same company. No subcontractor to the proposing audio-video contractor will be allowed for any portion of the audio-video scope of work.

D. The System Installer shall meet all applicable regulations of the State and Department of Labor insofar as they apply to this type of system. The bidder shall be a firm normally employed in the audio-video industry and shall provide a reference list of ten (10) projects of equivalent size or larger and contact names confirming successful completion of projection system installations.

E. The bidder shall have an authorized service center, within 75-miles of the project's location, for

the brand of equipment that is submitted for bid. The Owner, Architect, and Consultant reserves the right to perform an onsite inspection as they deem necessary.

F. The bidder must produce a letter from the manufacturer guaranteeing the delivery of all the equipment outlined in the specification herein.

G. The bidder shall have a full-time local service personnel capable of servicing the projector system described herein.

H. Manufacturer Qualification: Manufacturer of the controller with a minimum of five years record of satisfactory manufacturing and support of components comparable to the basis of the design system.

I. Source Requirements: Provide control panel, amplifier/switch, loudspeaker, receiver, microphone hardware, and software through a single source from a single manufacturer.

J. All miscellaneous equipment required for a complete, professional installation shall be included in the base bid. No allowances for any additional equipment, hardware, cabling, or miscellaneous will be considered unless specifically excluded from the base bid.

K. All work materials shall be removed at the end of the workday and the work area left in the same condition as found.

L. The work herein specified shall be performed by fully competent workmen, thoroughly. All materials furnished by the Contractor shall be new, and all work shall be completed to the satisfaction of the Architect/Engineer.

M. All equipment shall be held firmly in place. This shall include speakers, receiver/amplifiers, cables, etc. Fastenings and supports shall be adequate to support their loads with a safety factor of at least three. All switches, connectors, outlets, etc., shall be clearly, logically, and permanently marked during installation.

N. The Contractor must take such precautions as are necessary to guard against electromagnetic and electrostatic hum and ground loops, to supply adequate ventilation, and to install the equipment to provide maximum safety to the person who operates it.

O. Care shall be exercised in the wiring to avoid damage to the cables (e.g., stapling, pinching, excessive bending) and to the equipment. All joints and connections shall be made with lead-free rosin-core solder or with mechanical connectors approved by the Engineer. All wiring shall be executed in strict adherence to standard broadcast practices.

P. The Contractor shall be established communication and electronics Contractor that has had and currently maintains a locally run and operated business for at least five years. The Contractor shall utilize a duly authorized reseller of the equipment supplied for this project location with full Manufacturer's warranty privileges.

Q. The Contractor shall test the installed System according to the Manufacturer’s instructions and verify that the equipment has been installed properly and is functioning as designed.

R. Manufacturer Qualifications: Approved manufacturer of controller listed in this Section with a minimum of five years record of satisfactory manufacturing and support of components comparable to the basis of the design system.

1. Approval of Comparable Products: Submit the following by project substitution requirements, within the time allowed for substitution review:
   a. Product data are indicating compliance with the requirements of this Section.

b. Samples of each component.
c. Sample submittals from a similar project.
d. Project references: Minimum of 5 completed installations, with Owner and Architect contact information.
e. Sample warranty.

2. Substitutions following the award of the contract are not allowed except as stipulated in Division 01 General Requirements.
3. Approved manufacturers must comply with separate requirements of Submittals Article.

S. Regulatory Requirements: Provide components and systems that comply with the requirements of the following:
1. Refer to Section 1.3

1.8 PRE-CONSTRUCTION MEETING

A. The successful Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.

B. The contractor shall provide a mockup of the complete integrated audiovisual system solution for each of the typical spaces below before implanting the installation in multiple like rooms. Mockup shall include all products listed in part 2 of this specification. Coordinate with G.C., Architect, Consultant, and Owner for scheduling and location of mockup.

C. All proposing contractors must have ability to demonstrate a/v system being proposed and provide owner with completely installed system to evaluate performance and operation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of controls system that fail in materials or quality within the specified warranty period following substantial completion.
1. Warranty Period: Wireless transmitters, wireless receivers, infrared sensors, loudspeakers, and charging stands: 5 years.
2. Warranty Period: Rechargeable batteries, power cords, power supplies: 1 year.
3. Warranty Period: Other components: 3 years.

B. Manufacturer's Extended Support Service: Extended telephone support: Unlimited period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide products of FrontRow Calypso LLC, 1609 Corporate Circle, Petaluma, CA 94954, Phone +1 707 227 0735, www.gofrontrow.com. The parts numbers in numeral 2.2 below correspond to the kit order number, which includes cables and accessories that are necessary to meet the performance criteria. Substitution request to follow the procedure set up in General Conditions and to be approved by the Owner Representative 15 days before the Bid date.

2.2 AV SYSTEM COMPONENTS

A. The following performance parameters for devices include all parts.

B. Control panel:
1. Basis specification: FrontRow #CB-2050

2. Mounting: Dual-gang
3. User controls: 8-button control plus a rotary and push-effect knob.
4. Simultaneous control capacity: Unlimited network (IP addressable) devices, two bi-directional serial devices, plus 1 IR device or 1 GPI
5. Security passcode: Yes
6. Battery back-up: No
7. File-based cloning: Yes
8. IR command learning: Yes
9. Configuration: Via web-browser
10. I/O:
    a. 1x RJ-45 for power and control of 2 bi-directional serial and either 1 IR device or GPI
    b. 1x RJ-45 for 10/100Mb network, power
11. Serial Baud rate: 2400 to 115k
12. Weight: 113g/4oz
13. Power: 12VDC, 125mA (via Cat 5)
14. Size: 11.4 x 11.4 x 3.3cm/4.5 x 4.5 x 1.3125in

C. IN-CEILING MEDIA CENTER:
1. Basis specification: FrontRow ezRoom Voice & Alert Trio
2. Microphone
    a. Elevate Teacher Microphone
    b. Elevate Student Microphone
    c. FlipCharge Microphone Cradle Charger
    d. Elevate Base Station
    e. User programmable trigger button embedded in microphone for customizable emergency alerts, office communication or device control.

D. Mounting:
1. Plenum-rated 2x2 ceiling enclosure, FrontRow
    a. Lockable lid: Yes
    b. ETL Listed for UL 2043 compliance: Yes
    c. Dimensions: 23.81” x 23.70” x 3.22”
    d. Weight (enclosure only): 18.5 lbs
    e. Mounting hardware to include four cable locks, two cable clamps, and one nylon bushing.
2. Surface mounted enclosure, FrontRow 1000-00116:
    a. Lockable lid: Yes
    b. ETL Listed for UL 2043 compliance: Yes

E. Network Switch (pre-installed)
1. Inputs/Outputs: 5 RJ45 Ports
2. Network Support: 10/100Mb/s (Auto Sensing)
3. Connection Type: Supports Auto MDI/MDIX
4. Flow Control: IEEE 802.3x
5. Weight: .11 kg/.25lbs
6. Size (wxhxd): 10.4 x 2.2 x 7cm/4.06 x .875 x 2.75in

F. Loudspeakers:
1. Basis specification: FrontRow integrated Trio three-speaker array built into the 2x2 enclosure
2. Power output: 40 Watts peak program
3. Acoustic Frequency response: 50 Hz to 20 kHz
4. DC Power Input: 12-18Vdc/3A
5. Signal-to-noise: >70 dB

6. Total Harmonic Distortion: <1% @ 1kHz

H. Wall plates AV-1
1. Basis specification: FrontRow pass through HDMI type A (single-gang)
   a. Inputs: female HDMI
   b. Profile: single-gang Decora® style wall plate
   c. Cabling: Plenum-rated 66ft HDMI optical
   d. Video Specification:
      1) Resolution (HDTV) 4K/UHD(3840x2160, FHD(1080p)
      2) Resolution (PC) All VESA Resolution (4096×2160) / All VESA Resolution (1920×1200)
      3) Data Rates 10.2 Gbps
      4) Pixel Clock Rates 300 MHz
      5) Power Consumption 0.25W
   e. HDMI Optical Cable Specification
      1) Length(m) Max100
      2) Diameter 3.4mm
      3) Weight 10m 0.18kg / 100m 1.64kg
      4) Tension 500N (50kg)
      5) Jacket Plenum (CMP-OF) / LSZH (Low smoke zero halogen) / Poly Urethane
2. Basis specification: FrontRow USB (type B) single-gang, with USB (type B) port, and 3.5 mm jack audio input.
   a. USB Cable:
      1) 15m/ 50ft active USB Cable;
      2) Built in Repeater;
      3) A-Male to B-Male;
      4) Plenum rated.

I. Wall plates AV-2
1. Basis specification Semtron WP-PT1-SS pass-through grommet plate. To be located by the projector or Smart Panel. There will be no termination for the cables plugging into the visual device. Must include rubber grommet.

J. Teacher Transmitter/Microphone:
1. Basis specification: Front Row CM900 ELEVATE ACTION Teacher Microphone
   a. Transmission type: Infrared
   b. Transmitting frequency: 2.1MHz, 2.3MHz, 2.4MHz, 2.8MHz, 3.3MHz, 3.6MHz programmable
   c. Frequency response: 70Hz – 8kHz
   d. Microphone: Unidirectional cardioid
   e. Minimum typical battery life: 7 hours
   f. Battery type: Li-Ion, 3.7V, 850mAH
   g. Operating range using IRG3 technology: 30.5m/100ft, line of sight
   h. Must allow adjustment of transmit power via software
   i. Maximum size (WxHxD): 7.4 x 6.6 x 1.3cm/2.9 x 2.6 x 0.5in
   j. Maximum weight including battery and lanyard: 73.7g/2.6oz
   k. Indicators: LEDs for power on, battery status, and mute
   l. Shall have a maximum of one user control on the outside of the case: a combination wake/mute/voice command/trigger button
   m. Shall have a channel select switch inside the battery compartment
   n. Channel selection switch positions must be programmable to a minimum of 7 channels via software
   o. When used with an IP based Intercom system, the teacher transmitter/microphone must allow use as the intercom microphone during an

intercom call

p. Shall have the following inputs/outputs:
   1) 3.5mm aux input
   2) Charge/programming jack
   3) Must be identifiable in software via a user-customizable name
   4) Must transmit data on battery status to a receiver that is visible to the user on desktop software
   5) RoHS compliance: The transmitter shall be manufactured using a lead-free process and be free of hazardous metals and materials
   6) UL/cUL listing: The transmitter/microphone shall be UL and cUL listed

K. Charging Cradle
   1. Basis specification: FrontRow ELEVATE FlipCharger
   2. Minimum number of charging pockets: 2
   3. Each charging pocket must be able to charge either the teacher microphone or the student microphone
   4. Maximum size (WxHxD): 8.9 x 4.6 x 11.4cm/3.5 x 1.8 x 4.5in
   5. Maximum weight: 226.7g/8oz
   6. Power supply: 5.9V dc
   7. RoHS compliance: The charging cradle shall be manufactured using a lead-free process and be free of hazardous metals and materials
   8. UL/cUL listing: The charging cradle shall be UL and c-UL listed

L. Video Display and Projection Equipment
   1. Reference Section 27 51 05 Audio Video Systems and Equipment

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before installation, examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.

3.2 INSTALLATION

A. Comply with requirements of Division 27 Sections "Common Work Results for Communications."

B. Do not install AV or control devices until space is enclosed, HVAC systems are running, and overhead and wet work in the workspace is complete.

C. Install control devices by the manufacturer's instructions.

D. Install speakers by the manufacturer's instructions.

E. Install projector and mount by manufacturer's instructions.

F. Grounding: Provide electrical grounding by NFPA 70.

G. Perform setup for each audio-visual equipment component.

H. Connect sound from Interactive Display to FrontRow system to allow audio to project through local speakers.

3.3 SYSTEM STARTUP

A. Provide system startup and adjustment to occupied conditions by the manufacturer's recommendations.

B. Perform operational testing to verify compliance with Specifications. Adjust as required.

3.4 CLOSEOUT ACTIVITIES

A. Demonstration: The Contractor shall demonstrate the System to operate by the requirements of these specifications as well as the Manufacturer’s performance specifications. The test shall be performed in the presence of an authorized representative of the Owner.

B. Should such a demonstration of the performance show that the Contractor has not properly installed the System, the Contractor shall make all commercially reasonable changes or adjustments at no additional cost to the Owner.

C. Training: Train Owner's personnel to operate, maintain, and program AV controls, two in-service pieces of training at a minimum.

END OF SECTION 27 61 00

SECTION 27 61 05 AUDIO VIDEO SYSTEMS AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED WORK

A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
   1. Conditions of the Contract
   2. Division 1
   3. Division 26
   4. Division 27
   5. Division 28

1.2 WORK INCLUDED

A. Furnish and install classroom, large venue and conference room AV infrastructure inclusive of interactive monitors, projectors, projector screens, video wall, control, wall mounts, patch cords, labor and all supporting equipment to provide a complete and fully functional solution as described in this specification.

B. The drawings and specifications are to be considered conceptual in nature and are intended to establish system standards insofar as manufacturer type and system configuration. The contractor shall provide pricing of a complete engineered system based on the issued conceptual documentation. The engineered system is to be submitted to the project's consultant for review prior to installation.

1.3 QUALITY CONTROL

A. Installer Qualifications:
   1. The contractor shall be certified and shall meet all applicable regulations.
   2. The contractor shall be certified by the manufacturing company in all aspects of design, installation, and testing of the products described herein.
   3. The manufacturer shall have at the district's disposal, a certified employee or support phone number that can be reached during normal operating hours for product support and service.
   4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and metallic premise distribution systems and shall have personnel who are adequately trained in the use of such tools and equipment. Contractor shall provide evidence of minimum five (5) years' experience on similar structured cabling systems.
   5. A resume of qualifications shall be submitted with the contractor's proposal indicating the following:
      a. A list of five (5) recently completed projects of similar type and size with contact names, telephone numbers, and e-mail addresses for each.
      b. A list of procedures, inclusive of testing equipment and best practices, for testing the integrity of the cabling systems on this project.
      c. A technical resume of experience for the contractor's project manager and on-site installation supervisor who shall be assigned to this project.
      d. A list of technical product training attended by the contractor's personnel that shall install the structured cabling systems shall be submitted.
      e. Any subcontractor who shall assist the contractor in performance of this work shall have the same training and certification as the contractor.

B. The Contractor shall attend a mandatory pre-construction meeting with individuals deemed necessary by the Owner's representative prior to the start of the work.
   1. Items requested by the Owner/Engineer to finalize rack equipment configuration, rack cable management, rack cable terminations and other miscellaneous minor changes shall become part of the Contract Documents as supplementary information.
   2. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of this system with all other trades and existing conditions.

C. The products specified in Part 2 of this Specification shall be supplied by a single manufacturer, within the acceptable manufacturer groups, with the exception of data racks and other hardware that is not defined as part of the channel test configuration by TIA/EIA TSB67, Transmission Performance Specifications for Field Testing of shielded Twisted-Pair Cabling Systems outside plant (OSP) copper cable. Manufacturer shall have a minimum of seven (7) years' experience and shall be ISO 9001 Certified.

D. The Owner's representative reserves the right to reject all, or a portion of the work performed, either on technical or aesthetic grounds.

1.4 SUBMITTALS

A. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of Notice to Proceed:
   1. Wiring and interconnection schematics.
   2. Complete point-to-point wiring diagrams
   3. Riser diagrams.
   4. Complete floor plan drawings locating all system devices.
   5. Factory data sheets on each piece of equipment proposed.
   6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
   7. Complete system bill of material.

B. Documentation: Contractor shall provide documentation to include test results, and shop drawings. An example of test results as they will be presented should be included with the shop drawings. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:

C. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
   1. Complete manufacturer's product literature for all products installed during the Project for Operation & Maintenance.
   2. Inspection and Test Reports: During the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed conforms to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all connectivity testing was completed and that all irregularities were corrected prior to job completion.
   3. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. Provide three printed (3) copies.
   4. As-built Drawings shall include equipment layout and rack elevations. The as-built drawings shall be prepared using Auto Cad 2014 electronic format or later on CD format.

1.5 REFERENCES

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
   1. Local Building Code
   2. Local Electrical Code
   3. NEC National Electrical Code

B. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Classroom Control/Software/Cabling:
   1. Reference Specification Section 27 61 00 Integrated Audio-Video Systems and Equipment for Instructional Spaces
   2. No substitutions will be accepted

B. Interactive Monitors/Classroom AV
   1. Promethean ActivPanel 9 (A certified Promethean Installer is required)
   2. No substitutions will be accepted

C. Projector for Gymnasium
   1. Hitachi
   2. Epson
   3. Panasonic
   4. Refer elsewhere in the specifications for substitution requirements.

C. Flat Panel Display Monitors (FSD*)
   1. Samsung Commercial Series BE**T-H

D. Mounting Hardware
   1. Chief
   2. Crimson
   3. Peerless
   4. Promethean
   5. Refer elsewhere in the specifications for substitution requirements.

G. Speakers
   1. QSC
   2. Atlas Sound
   3. Reference Section 27 51 24 Local Sound Distribution System, for Dining and Gymnasium Sound systems
   4. Refer elsewhere in the specifications for substitution requirements.

H. Patch Cords
   1. Quiktron
   2. Liberty
   3. Refer elsewhere in the specifications for substitution requirements.

I. Audiovisual Distribution

1. Visionary Solutions
2. QSC

2.2 INTERACTIVE MONITORS/MONITORS

A. Interactive Monitors (IVD)
1. 75” screen size
2. 2160p (4K)
3. RS-232 serial port
4. Minimum of two (2) HDMI ports
5. Minimum of ten (10) points of touch
6. Interactive Monitors to be Titanium Series only

B. Monitors (FSD-1, FSD-2 and FSD-3)
1. 65” screen size for signage, 75” in PC Lab
2. Minimum 4K resolution
3. RS-232 serial port
4. Minimum of two (2) HDMI ports
5. 98” screen size in Library (refer to plan for location)

2.3 GYMNASIUM

A. Ceiling Mounted Projector - Gymnasium
1. Minimum of 6500 lumens.
2. RS-232 serial port
3. Minimum WUXGA Resolution
4. Minimum of two (2) HDMI ports
5. Shall have proper lens for rear projection, at specified distance.
6. Integrate audio with the Gymnasium Local Sound system specified in Section 27 51 24 Local Sound Distribution System

B. Mounting Hardware
1. Gymnasium
   a. 3’-5’ extension pole
   b. Speed tile above ceiling for support
   c. Universal projector mount for attachment
   d. Black

2. Interactive Monitors
   a. Minimum of 15” height adjust
   b. VESA Compliant
   c. Black
   d. Promethean Height-Adjustable Wall Mount

3. Standard Monitors
   a. Articulating Wall Mounts
   b. VESA Compliant
   c. Black

C. Audiovisual Distribution
1. Encoders/Decoders
   a. Encoders shall be Visionary Solutions Product no. E4200
   b. Decoders Shall be Visionary Solutions Product no. D4200
   c. Wallplate Encoder shall be Visionary Solutions Product no. E-WP-H

2. Audiovisual Control Panel

a. Shall be QSC Product no. TSC-101-G3

2.4 LIBRARY

A. Speakers
1. QSC CP8
B. Control Panel
1. QSC TSC-101-G3
C. Cable
1. Speakers
a. Shielded 16/2 for each speaker
D. Two AV-1 inputs shall be connected to FSD.

2.5 MOTORIZED PROJECTION SCREENS (MPS):

A. Manufacturer: Tensioned Large Advantage Deluxe" as manufactured by Da-Lite Screen Company or equivalent product by Draper, Inc.
1. Viewing Surface:
a. Aspect Ratio: 16:10
b. Gain: 1.3
c. 226.5" Diagonal, 120" high by 192" wide.
2. Mounting: Recessed above the ceiling.
3. Screen must be UL listed.
4. Motor: Entire drive unit shall be removable from case.
a. 3-wire, instantly reversible, with lifetime lubrication.
b. Internal thermal overload protector.
c. Fitted with mechanical brake to eliminate coasting.
d. Mounted on rubber vibration insulators.
5. Control Switch: Locate as directed by Architect.
a. Wall mounted, key-operated, 3-position control switch that will stop or reverse screen travel at any point in the operating cycle.
b. Controls shall be recessed and have a stainless steel cover plate.
6. Screen: Da-Lite Da-Tex rear projection screen with black border. Provide Black "extra drop" above picture area to 2 feet above Platform finished floor.
7. Case: Metal lined hardwood compartment with primer finish. Color shall be white. Cut matching gypsum board or ceiling tile and mount to aluminum doors to be flush with ceiling.

PART 3 - EXECUTION

3.1 GENERAL

A. Fire Wall Penetrations: The contractor shall avoid penetration of fire rated walls and floors wherever possible. Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

B. Inspection and Test Reports: During the project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed conform to Contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The contractor shall also provide documentation which indicates that all termination testing was completed and that all irregularities were corrected prior to job completion.

C. Operating and Maintenance Instruction for all devices within the system: These instructions shall reflect any changes made during construction.

D. As-Built Drawings will include cable pathways, outlet locations with correct labeling and the installing wiring and connectivity diagram of the proposed projection system including the sound reinforcing equipment.

E. The as-built drawings will be prepared using AutoCAD 2012 or later. Provide the owner with one Mylar plot of each drawing and one-half prints of each drawing. Provide the owner with electronic versions of the as-built on CD ROM.

F. Conduit Fill shall not exceed 40%.

G. Damage:
1. The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over-tightened bindings, loosely twisted and over-twisted pairs at terminals and cable sheath removed too far (over 1-1/2 inches).
2. The Contractor shall replace any damaged ceiling tiles that are broken during cable installation.

H. Clean-up: All clean-up activity related to work performed will be the responsibility of the contractor.

3.2 INSTALLATION

A. Projector Installation Gymnasium:
1. Install in accordance with manufacturer’s printed instructions.
2. Coordinate with electrician for proper installation of electrical and wall mounted electric operator(s) where specified.
3. Coordinate with other trades as required to mount projection screens centered about ceiling mounted projectors. Coordinate exact projector locations with the architect.
4. Coordinate sound input with Division 26.
5. Provide and install all necessary patch cords.
6. Provide and install necessary lens, to incorporate correct throw to the specified screen size.
7. Shall be mounted from the red iron, and brought down to the appropriate level, to match the screen size, as specified in Division 11.
8. Coordinate audio distribution via the local sound system specified in Integrate audio with the Gymnasium Local Sound system specified in Section 27 51 24 Local Sound Distribution System. Provide all materials required to distribute audio via the specified sound system for this space.

B. Display Installation Library:
1. Install in accordance with manufacturer’s printed instructions.
2. Coordinate with electrician for proper installation of electrical and wall mounted electric operator(s) where specified.
4. All equipment shall be mounted to the monitors.
5. Provide and install all necessary patch cords.
6. Control shall be run from wall mounted control panel
7. Ensure that both connections within the Library are fully operational.
8. Provide wall mounted speakers adjacent to and connected to the flat panel display
9. Provide a complete assembly of (1) IVD and (1) Promethean mobile cart for mobile display for use in library.

C. Interactive Monitor:
1. Install in accordance with manufacturer's printed instructions.
2. Coordinate with electrician for proper installation of electrical and wall mounted electric operator(s) where specified.
3. Coordinate with other trades as required to mount projection screens centered about ceiling mounted projectors. Coordinate exact projector locations with the architect.
4. Provide and install all necessary patch cords.
5. All IM mounts shall be the Promethean branded height-adjustable mounts.
6. All IM shall be connected to teacher's desk via USB cabling, for command/control of PC or laptop by IM

D. Monitors
1. In Computer Lab A135 provide an HDMI splitter, share image from Interactive Monitor to the commercial display.

E. Large Group + KIVA
1. The audio/video systems in the Large Group space and KIVA space shall be capable of operating as one large space, or two independent spaces.
2. Utilize FrontRow CB6000 for control and functionality within the space.

3.3 WIRING INSTALLATION

A. Install cables as recommended by the system manufacturer. Conductor quantities specified are minimum required. Conductors to be installed shall be coordinated with the system equipment supplier.

B. All cable must be handled with care during installation so as not to change performance specifications. Factory twists of each individual pair must be maintained up to the connection points at both ends of the cable. There shall never be more than one inch of unsheathed cable at any termination.
1. Wiring within Enclosures: Provide adequate length of conductors. Bundle, and lace the conductors to terminal points with service loop. Provide and use lacing bars where appropriate. Cabling shall be neatly strapped, dressed, and adequately supported.
2. Identification of Conductors and Cables: All cables shall be marked with wrap-around number or letter cable markers at both ends with clear shrink tube covering the label. There shall be no unmarked cables at any place in the system. All cable markings shall correspond with system wiring diagrams and as-built documentation.
3. Connection Practices: All wiring connections shall be made with approved mechanical connectors.

C. Exposed Cable:
1. All cabling shall be installed inside walls or ceiling spaces whenever possible.
2. Cables installed on exposed surfaces, in inaccessible locations, or underground shall be installed in conduit.

D. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the owner's efficient use of their full capacity.

E. Cable Routes:
1. All cabling placed in ceiling areas must be in conduit, cable tray or J-Hooks. Cable supports shall be permanently anchored to building structure or substrates. Provide attachment hardware and anchors designed for the structure

to which attached and that are suitable sized to carry the weight of the cables to be supported. Do not route cable through webbing of structural steel. Cabling must be supported in dedicated supports intended to support cabling as described in this section.

2. Attaching cable to pipes or other mechanical items is not permitted. Use J-Hooks for up to 15 cables (Chatsworth hooks with appropriate brackets). Communications cable shall be rerouted so as to provide a minimum of 18 inches spacing from light fixtures, sources of heat, power feeder conduits and EMI sources. Cabling shall not be attached to ceiling grid support wires. Cable runs shall be parallel or perpendicular to building structure. Multiple cables to be bundled together every 6 feet.
3. All cables not installed in conduit shall be plenum rated.
4. Cables not installed in conduit shall be grouped and bundled. Cable shall be bundled on a maximum of 2'-6" on center and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.
5. Cables installed in hollow wall spaces shall be installed in conduit to an accessible location.

F. Labels: The Contractor will label all outlets using permanent / legible typed or machine engraved labels approved by the owner (no handwritten labels permitted). The font shall be at least one-eighth inch (1/8") in height, block. All labels shall correspond to as-built and to final test reports.

1. Tag each circuit at each end and at each terminal with a separate tag indicating the area served.

G. Cable Support System: Cable saddles or J-Hooks shall be used to route all exposed cables (cable not in conduit or cable tray) in open access environments as well as in communications closets.

H. Cable Lubricants: After installation, exposed cable and other surfaces must be cleaned free of lubricant residue.

I. Allowable Cable Bend Radius and Pull Tension: In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation. Refer to the cable manufacturer's allowable bend radius and pull tension data for the maximum allowable limits.

J. Pull Strings: Provide pull strings in all new conduits including all conduits and cable installed as part of this Contract. Pull test is not to exceed 200 pounds. Data and video cables can be pulled together with pull strings.

3.5 FIELD QUALITY CONTROL

A. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform complete pre-testing. Determine, through pre-testing, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pre-testing. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved.

B. Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the systems.

C. Testing: Upon completion of pre-testing, notify the Architect/Owner a minimum of 10 days in advance of acceptance test performance. Schedule and conduct tests in with Owner's designated personnel. Provide a written record of test results.

D. Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.

3.6 EXAMINATION

A. Examine conditions for compliance with requirements and other conditions affecting the performance of Video Systems Cabling. Advise Architect / Owner of any discrepancies between field conditions and drawings that effect subject work. Do not proceed until unsatisfactory conditions have been corrected.

B. Provide weekly status report. All concerns and issues related to maintaining the construction schedule should be addressed in these reports. Issues that are not documented in this format will be considered the sole responsibility of the Contractor.

C. Control Circuit Wiring: Install control circuits in accordance with NFPA 70 and as indicated. Provide the number of conductors as recommended by system manufacturer to provide control functions indicated or specified.

D. Install all cabling with a bend radius of no less than is recommended by the cable manufacturer.

E. Exposed Wiring: Where wiring is indicated to not be in metal raceway, provide cable UL approved for plenum installation.

3.7 CABLE TESTING REQUIREMENTS

A. Requirements:
1. Notification: The Owner and Engineer shall be notified one week prior to any testing so that the testing may be witnessed.
2. Inspection: Before requesting a final inspection, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.
3. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor’s use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation will be evaluated in the context of each of these factors.
4. Submit for approval, a sample of the form on which the test will be reported.
    a. Identify project.
    b. Provide a list of all system devices, arrange in numerical order of point addresses
        1) Show descriptor and location of each.
    c. Signatures of participants and observers.
    d. Results.
    e. Description of adjustment or corrections of defective components.
    f. Date.
5. Test, calibrate and adjust each device in the system.
6. Verify operation of all specified functions.
7. Provide documentation of all tests and verifications as specified.

B. Errors: When errors are found the source of each shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Re-test results must be provided on Owner approved forms and witnessed by the Owner.

1. Continuity – As tested in the above testing requirements.

3.8 GRAPHIC FLOOR PLANS

A. Provide two (2) color coded floor plan detailed with actual room names, actual graphic room numbers as directed by the Owner, and adequate information to indicate group / zone / circuit information with non-fading floor plan media. Do not use architectural plan room names and numbers.

B. The floor plan shall be solvent welded in acrylic plastic. Mount in an extruded aluminum frame.

C. Install graphic floor plans as directed by Architect / Owner prior to substantial completion. Each area or room designation shall be verified with the communication device during testing.

3.9 GROUNDING OF EQUIPMENT

A. Equipment shall be grounded to the metallic structure of the building or to the building system power ground in accordance with NEC Section 250. Securely bond equipment to the ground system through a minimum 14-gauge green insulated conductor.

B. Electronic systems shall be grounded to the building system ground, with a maximum resistance of 0.1 ohm. Systems ground may be a driven ground rod, building steel, or other approved ground of the building power systems ground.

C. Ground equipment, conductor, and cable shields to eliminate shock hazard and to minimize to the greatest extent possible: ground loops, common mode returns, noise pickup, cross talk, and other impairments.

3.10 COMMISSIONING

A. Demonstrate to the Owner that Adjusting, balancing, and alignment all equipment has been completed for optimum quality and meets the manufacturer’s published specifications.

B. Demonstrate that the final system adjustments and tests meet the performance requirements. Provide all labor, materials, tools and measurement equipment required.

C. The Contractor shall satisfy all criteria requirements to the Owner’s satisfaction at no additional cost to the Owner.

3.11 TRAINING

A. Provide four days of training performed by factory authorized technicians for the Owner’s appointed personnel. This training shall be administered in four (4) hour sessions on each day, time and dates as selected by the Owner. Training shall occur after substantial completion using the installed and fully functional system. Training shall include, but not limited to proper usage of system as well as maintenance requirements of system. Provide all training materials and documentation required for owner to operate, configure and maintain all components of system.

3.12 WARRANTY

A. The Contractor shall warrant the systems within this specification to be free of defects in materials and workmanship for not less than one year from the date of final acceptance of the Video Systems. Defects occurring in materials or labor within the warranty period

shall be rectified by replacement or repair. Within this warranty period answers to service calls and/or requests for information shall be provided to the Owner within a 24-hour period and repair or replacement of any faulty item shall be completed within 72 hours, without charge, including parts and labor. This warranty shall not void specific warranties provided by the equipment manufacturers for greater periods of time or as specified otherwise for longer periods of time for specific products. It also shall not void any rights of the Owner guaranteed by law.

B. Upon Substantial Completion, the Contractor shall provide Owner with exact starting and ending dates of the warranty, as well as the name and telephone number of the firm's primary contact for service work.

C. Correct defects in material or workmanship with a minimum loss of operating time at no cost to Owner.

D. On-site service.

E. Warranty installation and workmanship of Owner furnished; Contractor installed equipment for a period of 1 year from date of substantial completion.

F. Warranty installation and workmanship of Contractor furnished; Contractor installed Promethean Active Panels are for a period of 5 year from date of substantial completion.

3.13 SERVICE AND MAINTENANCE

A. The contractor shall provide a 1-year warranty of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner during normal working hours. The warranty period shall begin on the date of acceptance by the Owner / Engineer.

B. The contractor shall, at the Owner's request, make available a service contract offering continuing factory authorized service of this system after the initial warranty period.

END OF SECTION 27 61 05

SECTION 28 01 00 OPERATION AND MAINTENANCE (O&M) MANUALS OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS operating and maintenance data as specified in this Section and as referenced in other sections of specifications.

B. Instruct Owner's personnel in operation and maintenance of equipment and systems.

C. Submit three (3) electronic copies, on separate devices (CD, USB Flash Drive, or some type of solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer’s operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.

D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.

E. Recorded video of all training sessions shall be included in each copy, of each system’s final submitted O&M.

F. The final submitted manual shall include a sing-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant’s stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System’s O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
1. Table of Contents for each element
2. Contractor information
3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant’s stamp of acceptance.
4. All parts and maintenance manuals for items of equipment
5. Warranties (without starting dates)
6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
7. Operating and maintenance procedures.
8. Form of Owner's Training Program Syllabus (including times and dates)
9. Control operations / equipment wiring diagrams
10. Coordination Drawings
11. Schedule of Low Voltage Wire and Cable
12. Schedule of ESS Equipment
13. Schedule of ESS Field Devices
14. Access Control Door Schedules
15. Video Surveillance Camera Schedules
16. Other required operating and maintenance information that are complete.
17. Cable pathway layout drawings and station map, including through wall and floor

penetration locations and sleeve sizes.

B. Copy will be returned to the Contractor within 15 days with comments for corrections.

C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.

D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.

E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.

F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
2. Minimum ring size: 1"; Maximum ring size: 3".
3. When multiple binders are used, correlate the data into related groupings.
4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

A. Form for Manuals Submitted in Hard Copy Format:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
2. Format:
   a. Size: 8-1/2" x 11"
   b. Text: Manufacturer's printed data or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab and bind in text.
   b. Fold larger drawings to size of text pages.
4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
   a. Title of Project
   b. Identity of separate structures as applicable
   c. Identity of general subject matter covered in the manual.
6. Binder as specified

B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
   a. Contractor, name of responsible principal, address and telephone number
   b. A list of each product required to be included, indexed to content of the volume.
   c. List with each product, name, address and telephone number of:
      1) Subcontractor or installer
      2) Maintenance contractor as appropriate
      3) Identify area of responsibility of each.
      4) Local source of supply for parts and replacement
   d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
2. Product Data:
   a. Include those sheets pertinent to the specific product.
   b. Annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Delete references to inapplicable information.
3. Drawings:
   a. Supplement product data with drawings as necessary to illustrate:
      1) Relations of component parts of equipment and systems
      2) Control and flow diagrams
   b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
   c. Do not use Project Record Documents as maintenance drawings.
4. Written text as required to supplement product data for the particular installation:
   a. Organize in consistent format under separate headings for different procedures.
   b. Provide logical sequence of instructions for each procedure.
5. Copy of each warranty, bond and service contract issued
   a. Provide information sheet for Owner's personnel, giving:
      1) Proper procedures in event of failure
      2) Instances that might affect validity of warranties or bonds
6. Shop drawings, coordination drawings and product data as specified.

C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
   a. Description of unit and component parts:
      1) Function, normal operating characteristics, and limiting conditions.
      2) Performance curves, engineering data and tests.
      3) Complete nomenclature and commercial number of replaceable parts.
   b. Operating procedures:
      1) Start up, break-in, routine / normal operating instructions
      2) Regulation, control, stopping, shut down and emergency instructions
      3) Special operating instructions
   c. Maintenance procedures:
      1) Routine operations
      2) Guide to trouble-shooting
      3) Disassembly, repair and reassembly
      4) Alignment, adjusting and checking

5) Routine service based on operating hours

d. Manufacturer's printed operating and maintenance instructions.

e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

1) Items recommended to be stocked as spare parts.

f. Schedule of low voltage wire and cable

g. Schedule of ESS equipment

h. Schedule of ESS field devices

i. Each Contractor's coordination drawings.

1) As installed color coded wiring and cabling diagrams.

j. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.

k. Other data as required under pertinent sections of the specifications.

2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 27.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION 28 01 00

SECTION 28 05 00 ELECTRONIC SAFETY AND SECURITY GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28.

B. Applicable provisions of this section apply to all sections of Division 28.

C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See Division 26 for related general and specific requirements.

1.2 CODES AND STANDARDS

A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:

1. Americans with Disabilities Act (ADA)
2. Authorities Having Jurisdiction (AHJ) - Local
3. American National Standards Institute (ANSI)
4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
5. Building Industry Consulting Services International (BICSI)
6. Code of Federal Regulations - Title 47
7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
11. International Electro-technical Commission (IEC)
12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
16. National Electrical Contractor's Association (NECA) *Standards of Installation*
17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
18. National Electrical Safety Code (NESC)
19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*

20. Society of Cable Telecommunications Engineers (SCTE)
21. Local Accessibility Standards
22. Telecommunications Industries Association (TIA) *(ANSI/TIA/EIA) Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*
23. Uniform Building Code (UBC)
24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*

B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.

C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.

D. Obtain all permits required.

1.3 SUMMARY

A. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

1.4 SPACE REQUIREMENTS

A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

1.5 RELATION WITH OTHER TRADES

A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.

B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.

C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.

D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.

E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall

furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.

1. Make final connections to all ESS equipment indicated on the drawings, except as noted.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

1.6 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

1.7 GUARANTEE

A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.8 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.9 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.10 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 28 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

1.11 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:
1. Obtained from utility maps and other substantially reliable sources.

2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

1.12 CONTRACT DRAWINGS

A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

1.13 ABBREVIATIONS AND DEFINITIONS

A/V	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode
M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet *(Now referred to as TR)*
TR	Telecommunications Room *(A.K.A. TC - Telecommunication Closet)*
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

1.14 QUALITY ASSURANCE

A. Equipment Standards:
1. System and all components shall be brand new stock from manufacturer.
2. All electronics shall be 100% solid state.
3. System and all components shall bear a UL Label.

B. Contractor Qualifications:
At the time of Proposal, the Contractor shall:
1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
3. Hold all legally required state registrations to meet local requirements for submittal drawings.
4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

1.15 SUBMITTALS

A. Provide SUBMITTALS according to Division 1 and the following.

B. Requirements:
1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
2. Submit proof that all system components and cables are U.L. Listed.
3. An equipment list with names of manufacturers, model numbers, and technical information on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the

submitter shall replace or modify such equipment at once and without cost to the Owner.

1.16 EXAMINATION OF SITE

A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.

B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.17 DATA ACCURACY

A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.18 SECURITY

A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.

B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.19 UTILITIES

A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.20 PERMITS

A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.21 NOTIFICATION

A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day’s notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections,

etc., necessary to establish or re-establish any system shall be completed by the Contractor in close coordination with the Owner.

1.22 INTERFERENCES WITH THE OWNER

A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

1.23 PROJECT RECORD DOCUMENTS

A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.

B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2012 / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: “2 sets of CDs and prints for Owner’s use, one set of CDs, prints, and mylars for Architect / Engineers Records”. Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
1. 3 sets of electronic AutoCAD (2012 dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
3. Three sets of blue or black-line prints of each contract as-built drawing.

C. As-Built Drawings should indicate the following information as a minimum:
1. Indicate all addendum changes to documents.
2. Remove Engineer’s Seal, name, address, and logo from drawings.
3. Mark documents AS-BUILT DRAWINGS.
4. Clearly indicate: DOCUMENT PRODUCED BY:
5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
6. Indicate exact location of all underground ESS raceways, and elevations.
7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
10. Exact location of all ESS equipment in and outside of the building.
11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
13. Cloud all changes.

1.24 OPERATING TESTS

A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.25 WARRANTY

A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.

B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.26 BUILDING CONSTRUCTION

A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.27 TEMPORARY FACILITIES

A. General: Refer to Division 01 for general requirements on temporary facilities.

B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.

C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED:

A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.

B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.

C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.

D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.

E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.

F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.

G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.

H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.

I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.

J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.

K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation if applicable, the more stringent shall apply.

L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.

M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.

N. The installation shall be performed in a professional manner.

O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.

Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.

R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

3.2 COORDINATION WITH OWNER / ARCHITECT

A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

3.3 CUTTING, PAINTING, AND PATCHING

A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.

B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

3.4 WIRE AND CABLE

A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.

B. All wires in exposed areas shall run through conduit as specified in Division 26.

C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.

D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.

E. Run wires continuously from termination to termination without splices.

F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at not rime shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.

G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2” or larger sized conduits.

H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.

I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports, all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

3.5 IDENTIFICATION AND TAGGING

A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 *or equal*). Hand written tags are not acceptable.

B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.

C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.

D. Identification of Equipment:
1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.

2. A black-white-black 3 layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
   a. Identifying nameplates shall have 1/2-inch high, engraved letters.
3. Permanent, waterproof, black markers shall be used to identify each ESS grid junction box, clearly indicating the type of system available at that junction box.
4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.

E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.

F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of ESS facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.

G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.

H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried ESS lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

3.6 CUTTING AND PATCHING

A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

3.7 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
   1. Provide the training during regular working day.
   2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.

B. Time to be allocated for instructions.
   1. Minimum of 12 hours dedicated instructor time
   2. 4 hours on each of 3 days
   3. Additional instruction time for specific systems as specified in other Sections.

C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
   1. One copy to the Owner
   2. One copy to the Architect / Engineer

D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.

E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.8 OPENINGS

A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.9 HOUSEKEEPING PADS

A. Provide concrete equipment housekeeping pads under outdoor mounted ESS equipment.

B. Concrete and reinforcing steel shall be as specified in Division 03, or as indicated or noted.

C. Concrete pads:
1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or as indicated on the drawings or in other sections of the specifications.
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.10 OBSTRUCTIONS

A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
   1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
   2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.

B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.11 VANDAL RESISTANT DEVICES

A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.12 PROTECTION

A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.13 EQUIPMENT BACKBOARDS

A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
   1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
   2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

3.14 SITE MANAGEMENT RESPONSIBILITY

A. The Contractor shall provide an on-site Project Manager as defined in SUPERVISION OF WORK portion of this Section.

3.15 START-UP RESPONSIBILITY

A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect’s judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer’s factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.

B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.

C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

3.16 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.

B. All materials shall be neat, clean and unmarred, and parts securely attached.

C. All extra material as specified shall be delivered and stored at the premises as directed.

D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

3.17 SYSTEM ACCEPTANCE REQUIREMENTS

A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.

B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that cam in the original shipping container for that piece of equipment. Include all warranty cards.

C. Testing:
1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports

shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.

D. As-Built Drawings:
1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.

E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
1. System Operations and Maintenance Manuals
2. System Test Reports
3. As-Built Drawings

3.18 NOTICE OF COMPLETION

A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION 28 05 00

SECTION 28 05 07 SHOP DRAWINGS, COORDINATION DRAWINGS AND PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Prepare submittals as required by Division 1 and as outlined below.

B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.

C. The term submittal, as used herein, refers to all:
1. Shop Drawings
2. Coordination Drawings
3. Product data

D. Submittals shall be prepared and produced for:
1. Distribution as specified
2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.

B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.

C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".

B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.

C. For each room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
1. Actual ESS equipment and components to be furnished.
2. NEC working space and NEC access to NEC working space.
3. Relationship to other equipment and components and openings, doors and obstructions
4. Rack location and dimensions

D. Identify field dimensions. Show relation to adjacent or critical features of work or products.

E. Verify location of ESS station devices and other work specified in this Division.
   1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
   2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.

F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.

B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.

C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.

D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.

E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer/Owner (Does Not Comply, Explanation:)

1.5 MANUFACTURERS INSTRUCTIONS

A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

1.6 CONTRACTOR RESPONSIBILITIES

A. Review submittals prior to transmittal.

B. Determine and verify:
   1. Field measurements
   2. Field construction criteria
   3. Manufacturer's catalog numbers
   4. Conformance with requirements of Contract Documents

C. Coordinate submittals with requirements of the work and of the Contract Documents.

D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.

E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with

Architect / Engineer's acceptance.

F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.

H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
1. Proper sizes and capacities
2. That the item will fit in the available space in a manner that will allow proper service
3. Construction methods, materials and finishes

I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

1.7 SUBMISSION REQUIREMENTS

A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

B. Number of submittals required:
1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.

C. Accompany submittals with transmittal letter, in duplicate, containing:
1. Date
2. Project title and number
3. Contractor's name, address and telephone number
4. The number of each Shop Drawing, Project Datum and Sample submitted
5. Other pertinent data

D. Submittals shall include:
1. The date of submission
2. The project title and number
3. Contract Identification
4. The names of:
   a. Contractor
   b. Subcontractor
   c. Supplier
   d. Manufacturer
5. Identification of the product
6. Field dimensions, clearly identified as such
7. Relation to adjacent or critical features of the work or materials
8. Applicable standards, such as ASTM or federal specifications numbers
9. Identification of deviations from contract documents
10. Suitable blank space for General Contractor and Architect / Engineer stamps
11. Contractor's signed and dated Stamp of Approval

E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
1. Finishes which involve Architect / Engineer selection of colors, textures or

patterns
2. Associated items requiring correlation for efficient function or for installation

1.8 SUBMITTAL SPECIFICATION INFORMATION

A. Every submittal document shall bear the following information as used in the project manual:
1. The related specification section number
2. The exact specification section title

B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.9 RESUBMISSION REQUIREMENTS

A. Make resubmittals under procedures specified for initial submittals.
1. Indicate that the document or sample is a resubmittal
2. Identify changes made since previous submittals

B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

1.10 CONTRACTOR'S STAMP OF APPROVAL

A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.

B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.

D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

A. The Architect / Engineer will:
1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
3. Return submittals to Contractor for distribution or for resubmission

B. Review of submittals will not extend to design data reflected in submittals that is

peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.

C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
   1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
   2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.

D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.12 SUBSTITUTIONS

A. Do not make requests for substitution employing the procedures of this Section.

B. The procedure for making a formal request for substitution is specified in Division 01.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION

3.1 SHOP DRAWINGS AND PRODUCT DATA

A. Submittals shall not be combined or bound together with any other material submittal.

B. Submit individually bound shop drawings and product data for the following when specified or provided:
   1. Low Voltage Wire
   2. Electronic Access Control and Intrusion Detection
   3. Electronic Surveillance
   4. Fire Detection and Alarm

3.2 COORDINATION DRAWINGS

A. Submit coordination drawings as specified.

END OF SECTION 28 05 07

SECTION 28 05 10 CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Perform work by persons qualified to produce workmanship of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.

D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions in full detail, including each step in sequence.

B. Should instruction conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specification Sections, manufacturer shall provide a manufacturer’s qualified personnel to observe:
1. Field conditions.
2. Condition of installation.
3. Quality of workmanship.
4. Start-up of equipment.
5. Testing and adjusting of equipment.

B. Manufacturer’s qualified personnel shall make written report of observations and recommendations to Architect/Engineer.

1.7 MOCK UPS

A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

C. Acceptable mock-ups in place shall be retained in the completed work where possible.

D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
   1. Rough-in
   2. Finish with all appurtenances in place
   3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

A. Contractor shall provide all adjustments and modifications as requested by the manufacturer’s qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION 28 05 10

SECTION 28 10 00 ACCESS CONTROL SYSTEM (ACS)

PART 1 - GENERAL

1.1 RELATED WORK

A. The following, in their entirety and as applicable, shall apply to this section. Including any associated drawings.
1. Conditions of the Contract
2. Division 1
3. Division 26
4. Division 27
5. Division 28

1.2 WORK INCLUDED

A. The Contractor shall furnish and install a complete microprocessor-based access control system as specified herein. The system shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

B. Security system devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system, meeting the requirements of this specification. The Contractor shall provide all system devices required for complete system perimeter monitoring acceptable to all governing authorities, Architect and Owner.

C. The system shall include security for all access into building, including but not limited to the following:
1. System Server
2. Control Panels
3. Power Supplies.
4. Interconnection of panels.
5. Installation of new devices.
6. Installation of card reader.
7. Installation of electronic locking hardware
8. Installation of request to exit devices
9. Installation of door position sensors
10. Installation of door hardware (as specified herein and/or in Division 08, door hardware)
11. Lockdown and Lockout Buttons
12. Audio Intercom Systems
13. Licensing
14. Integration
15. All additional material, hardware, and labor required for a fully functional, turnkey system

D. The contractor shall connect each controller to the ACS Management System.

E. All system programming will be performed by the system installer. The system installer will be required to meet with the Owner, engineer, and system manager to discuss wiring and termination of the system control panels and field devices prior to installation.

F. Licensing: The contractor shall NOT utilize any of the owner's existing licensing for this scope of work. All licensing shall be provided by the contractor, no exceptions. Including, but not limited to the following:
1. Portal Licensing
2. Controller Licensing
3. Wireless Licensing
4. Video Management Software Integration Licensing

G. Contractor to refer to Division 8 Door Hardware specification. Provide and install all hardware specified to be provided by the "Access Control Contractor", "Security Installer", "Division 28", or any variation thereof.

H. The documents issued for this project are conceptual in nature, including but not limited to specifications and drawings. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system, and documents accepted do not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

I. The cost of the work specified in this section is included in an allowance.
1. Selection of subcontractor will be determined at a future date.

1.3 REFERENCES

A. Code of Federal Regulations (CFR).

B. Institute of Electrical and Electronics Engineers (IEEE):
1. 802.3 Ethernet Standards.
2. IEEE 1100 Recommended Practice for Powering and Grounding Electronic Equipment.

C. International Electrotechnical Commission (IEC).

D. International Organization for Standardization (ISO):
1. ISO / IEC 10918 - Information technology -- Digital compression and coding of continuous-tone still images: Requirements and guidelines; JPEG.
2. ISO / IEC 14496-10 - Information Technology - Coding Of Audio-Visual Objects - Part 10: Advanced Video Coding; MPEG-4 Part 10 (ITU H.264).
3. ISO / IEC 23008-2 - High Efficiency Coding and Media Delivery In Heterogeneous Environments - Part 2: High Efficiency Video Coding; MPEG-H Part2 (ITU H.265, HEVC).

E. Federal Communications Commission (FCC):
1. FCC Part 15 – Radio Frequency Device

F. Underwriters Laboratories (UL):
1. UL294 – Access Control Systems Units

G. Electronic Industries Alliance (EIA)
1. RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-Point Systems

H. Federal Information Processing Standards (FIPS)

1. Advanced Encryption Standard (AES) (FIPS197)
2. FIPS201-2: Open Options DNA Fusion FIPS in conjunction with an E2-SSP-D2-FIPS, NSC-100-FIPS, RSC-2-FIPS and other listed components will provide an access control solution that is fully FIPS 201-2 compliant.
3. Personal Identity Verification (PIV) of Federal Employees and Contractors

I. Homeland Security Presidential Directive 12 (HSPD12)

J. National Fire Protection Association Standards:
1. NFPA 70 - National Electrical Code
2. NFPA 72 - National Fire Alarm Code
3. NFPA 101 - Life Safety Code

K. RoHS compliant

L. SIA AC-01-1996.10 - Access Control - Wiegand

M. Local & State Building Codes

N. Requirements of Local Authorities having Jurisdiction

O. Requirements of American Disabilities Act (Public law 101-336).

P. Texas Accessibility Standards (T.A.S.)

Q. Texas Insurance Code.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:
1. The installing contractor shall be the authorized representative of the Access Control Manufacturer to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the security alarm manufacturer's product for at least two years.
2. The installing contractor shall be licensed as required, by the State in which the project is located in, as a security services contractor to design, sell, install, and service security alarm systems.
3. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained service technicians.
4. The installing firm shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
5. All Contractors must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the access control system. No person is allowed to work on the system without proper manufacturer's certification.
6. The proposing contractor for this system and the installing contractor of this system shall be of the same organization. Absolutely no subcontracting of any portion of this system by the proposing contractor will be allowed.
7. The proposing/installing contractor of this system must be an authorized dealer / integrator for the project's specified Video Surveillance and the Intrusion Detection systems as well as the system specified in this section.
8. For proper, smooth, and complete integration of the IP security camera, access control, and intrusion detection systems; the proposing/installing contractor of the video surveillance and intrusion detection systems must be the same contractors.

9. Contractor must be a current integrator of solution in the closest major metropolitan area marketplace, have a permanent office located within 75-miles of the project, and be able to include information on current support staff to be able to service this client.

1.5 SUBMITTALS AND CLOSE-OUT

A. Product Data: Within fourteen (14) days of Notice to Proceed, the system installer shall furnish the following in a single consolidated submittal:
   1. Permits: The Contractor shall obtain all required permits and provide copies to the Owner / Architect / Engineer.
   2. Product Literature: Complete manufacturer's product literature for all system equipment, power supplies, cable, termination components, cable supports, cable labels, field devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Designer) and the manufacturer's supporting documentation, demonstrating compatibility with other related products shall be included. The submittal shall have some type of distinguishing marker or pointer to indicated what specific product is to be submitted.
   3. Construction Schedule: A time-scaled Construction Schedule indicating general project deadlines and specific dates relating to the installation of the cable distribution system.
   4. Specification Compliance: A letter shall be provided stating, by section and subsection, that the system installer complies with the ENTIRE specification section. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been accepted by the project's technology consultant.
   5. Certifications: The contractor shall submit all of the following certifications and the certifications must contain dates which are valid from the date of proposal and not expirer any sooner than 12 months after substantial completion of the project.
      a. Manufacturer's Authorized Dealer/Installer Certification: This certification must be held by the proposing/installing contractor and state that the proposing/installing contractor is and authorized dealer/installer of the system specified within the project specifications. The certification must have been obtained by the office that is within a 75-mile radius of the project's location.
      b. Installer Certification: This certification must be held by at least 25% of the, on-site, staff and be made available at the site if requested by the owner, architect, and/or project's technology consultant.
      c. Licenses: This includes all licenses required by the state in which the work is being performed, the federal government, local authorities having jurisdiction, and any organization in that governs the specific system

B. Shop Drawings: Submit the following items, for Owner review and approval, within twenty-eight (28) days of notice to proceed:
   1. Proposed circuit routing and circuit grouping plan prepared by a system registered designer. The designer's certification must be current. Identifiable, separate routing shall be shown for both the station cabling and any backbone trunk cabling.
   2. In addition to the cable routing, the submitted drawings shall indicate the following, even if the following is expected to be provided by the project's electrical or general contractor:
      a. Location of all control equipment and remote power sources

b. Locations of all field devices and outlets
c. Location of wall penetrations (all penetrations shall be sleeved and contain protective bushings at both ends)
d. Location of sleeved wall and/or floor pass-thru
e. Size of sleeve at each location installed
f. Quantity of cable passing through each sleeve
g. Conduit routing, size, quantity, and stub-up locations for any floor mounted outlets or outlets installed in casework.

3. Drawing Compliance: A letter shall be provided stating that the system installer complies with the entire project drawing, including all general, keyed, and notes to contractor. If the installer intends to deviate from any portion of the specifications, a detailed explanation of reason in which the installer would like to deviate shall be provided in addition to the specification compliance letter. No deviations shall be acceptable until they have been approved by the project's technology consultant.

C. Close-out Procedures: For review and acceptance, furnish an electronic copy of the following documents to the Architect / Engineer. Upon acceptance of the submitted close-out documents, provide four (4) copies on an electronic storage media (CD or USD Flash Drive) Labeled with the project name, date of submission, and the name of the submitting firm. Final copies shall be delivered directly to the project's Technology Consultant. The closeout submittals shall include the following and be packaged in a storable container with the physical storage media and any physical items listed:

1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied, and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Provide complete test reports for all cabling and devices that comprise system as outlined in this document.
3. Include the Name, address and telephone of the authorized factory representative with a 24-hour emergency service number.
4. The manual shall also include Manufacturer's data sheets and installation manuals/instructions for all equipment installed and a list of recommended spare parts.
5. Generic or typical owner's instruction and operation manual shall not be acceptable to fulfill this requirement.
6. An up-to-date record ("as-built") set of approved shop drawing prints that have been revised to show each and every change made to the system from the original approved shop drawings.
7. As-built Drawings shall include cable pathways; device locations with correct labeling, control equipment locations, remote power supply locations, cross connect locations, and lightning protection locations. The as-built drawings shall be prepared using AutoCAD 2014 or later.
8. All drawings must reflect point to point wiring, device address and programmed characteristics as verified in the presence of the engineer and/or the end user unless device addressing is electronically generated, and automatically graphically self-documented by the system.
9. A copy of the manufacturer's warranty on the installed system.
10. Any keys to cabinets and/or equipment and special maintenance tools required to repair, maintain, or service the system.
11. Operating and Maintenance Instructions for all devices within the system. These instructions shall reflect any changes made during the course of construction,

and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description. (4 copies)

12. Upon completion of the work and at a time designated by the Architect or owner, provide formal training sessions for the Owner's operating personnel to include location, operation, and maintenance of all included systems and equipment. Provide a video copy of the training session as well as all sign in and training sign off sheets
13. One (1) 30" x 42" laminated floor plan sheets illustrating device locations, system wiring configuration, and cable designation. Contractor shall provide one complete floor plan sheet at each panel location.

1.6 DEFINITIONS

A. Abbreviations:

1.	ACS	Access Control System
2.	VMS	Video Management System
3.	NVR	Network Video Recorder
4.	IDS	Intrusion Detection System
5.	GUI	Graphical User Interface
6.	IP	Internet Protocol
7.	CR	Card Reader
8.	DS	Door Station
9.	MS	Master Station
10.	PIR	Passive Infrared Sensor
11.	LD	Lockdown
13.	LO	Lockout
14.	MDF	Main Distribution Frame
15.	IDF	Intermediate Distribution Frame

B. Definitions:

1. Access Card: A coded employee card, usually the size of a credit card, recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, wiegand-effect, proximity (active/passive), barium ferrite, smart/intelligent cards, and NFC enabled applications on mobile devices.
2. Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secured areas.
3. Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through and the times they are permitted.
4. Anti-Pass back (Anti-Tailgating): This feature protects against more than one person using the same card or number. It defines each system card reader and card ID number as IN, OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.
6. Alarm: A signal that indicates a problem.
7. Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.
8. Badge: Badge is a template or a design for creating a card. DNA Fusion includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.
9. Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.
10. Biometrics: A general term for the verification of individuals using unique

biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).

11. Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.
12. Controller: A microprocessor-based circuit board that manages access to a secured area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.
13. Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.
14. Digital Video Recorder: A security system device that records the video from the surveillance cameras (IP and Analog) on a hard disk.
15. Door: A generic term for a securable entry way. In many access control applications, a "door" may be a gate, turnstile, elevator door, or similar device.
17. Duress: Forcing a person to provide access to a secure area against that person's wishes.
18. Input: An electronic sensor on a controller that detects a change of state in a device outside the controller.
19. Integrated lockset: An integrated, intelligent locking solution that typically runs on batteries, but can be externally powered, that contains most of the door components, i.e. reader, door contact, and request to exit in a single, mountable unit.
20. Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer keyboard.
21. Output Relay: A device that changes its state upon receiving a signal from a controller. Typically, the state change prompts an action outside of the controller such as activating or deactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.
22. Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.
23. Time Schedules: Schedules that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.
24. Video Management System: An enterprise-class video management and storage solution

1.7 PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to starting work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Handling: Handle materials to avoid damage.

1.9 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under

environmental conditions outside manufacturer's recommended limits.

1.10 SEQUENCING

A. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

1.11 WARRANTY

A. The ACS furnished by the System Integrator including wiring, software, hardware and third-party products shall be fully warranted for parts, materials and labor for a minimum of 1 year from date of the final acceptance.

B. Manufacturer shall provide a limited 3-year warranty for the product to be free of defects in material and workmanship.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Head-End/Software
1. OpenOptions DNA Fusion with Open dX data exchange application

B. Controllers
1. OpenOptions

C. Enclosure / Power Supply
1. LifeSafety Power

D. Card Readers
1. HID (refer to Div. 8)

E. Wiring
1. Belden
2. Tappan Wire & Cable
3. Windy City Wire

F. Miscellaneous Devices
1. DP/DT Door Position Sensors (Door Contacts) – (refer to Div. 8)
2. Door Release Buttons – (refer to Div. 8)

2.2 SERVERS AND USER INTERFACE

A. Servers and User Interfaces are existing to remain. The system installer shall coordinate the installation of all new equipment and/or existing equipment that is affected by the project's scope. All equipment shall be modified and/or added in compliance with the existing systems parameters. The system installed shall provide and additional equipment to furnish a complete expansion of the system as shown on the project drawings, access control schedule, details, and legends.

2.3 ACCESS CONTROL SYSTEM (ACS)

A. General: The ACS is a modular and networked based system providing physical access control security to a Wide Area campus enterprise. The system shall be capable of controlling and integrating multiple security functions including the configuration, management and monitoring of cardholder access, locking hardware units, events, alarms, visitors, and real-time tracking and reporting. The ACS is to be alterable at any time depending on the facility requirements and will allow for easy upgradeability or modification of network processors, controller, interface modules, card data, inputs, outputs, and remote workstations. The ACS shall include, but is not be limited to, the following:

1. Client/Server model operating central server host software modules and client workstation software applications in a multi-user and a multi-tasking environment.
   a. The ACS to permit multiple instances of client software applications to run simultaneously on the network. The base system shall include one (1) software application licenses per site with an unlimited number of licenses available subject to connection fees.
2. Partitioning: The system to support security partitioning enabling system administrator to segment the configuration database and group multiple entities within the security partition.
   a. Security partitions limit what users can view in the configuration database. Administrators, who have all rights and privileges, can segment a database into multiple security partitions. A user who is given access to a specific partition will only be able to view entities (components) within the partition they have been assigned.
3. Encryption: The system to support encrypted communication between the central server software and client software applications (sever-to-server and client-to-server) using a 128-bit AES encryption algorithm (at a minimum).
   a. Communication between the central server host software module and system controllers to be encrypted if supported by the controllers.
   b. The ACS client software applications to be password protected with passwords stored in the central server database in an encrypted manner.
4. Distributed Processing: The system is a fully distributed processing application allowing information, including time, date, zones, valid codes, tasks, access levels, and similar data, to be downloaded from the central host station to controller interface devices allowing access-control decisions with or without central host station communication. If communications to a central host station are lost, the controllers will automatically buffer event transactions until communications are restored and events are automatically uploaded to the central host station.
   a. Provide for a higher level of distributed database management at defined perimeter access points such that no single point of failure will allow more than two access points to fail, or affect more than two access points at perimeter points system wide.
5. Single Data Base: The system to support a single database for access control site setup, credential and identity file creation, alarm and control setup, and system user operation and command functions.
6. System Access Management: The system to allow operators through password authentication the ability to make access granted or denied decisions, define access levels, time zones, holidays, assign cardholders, access groups, develop tasks, and generally manage access control, alarm monitoring and response activities system wide from a single login. Operator and user privileges are managed by a system administrator allowing for different levels of system access and system control. Authorization management is fully Owner definable.
7. Cardholder Management: The system to include a cardholder management system integrated within the access control system. This cardholder management functionality allows the enrollment of cardholders into the database,

and import / export of employee data.

8. Access Groups and Access Levels: The system to provide adequate access groups and access level assignment capability to meet Owner requirements for the specified project. If required, software application can be expandable to support unlimited access groups and access levels.
9. Alarm Monitoring: The system is able to monitor, report, and provide information about the time and location of alarms, along with their priority.
10. Event Monitoring: The system is able to monitor, report, and archive network access control activity.
11. Transaction Logs: The system to support an unlimited number of logs and historical transactions (events and alarms) with the maximum allowed being limited by the amount of hard disk space available.
12. System Monitoring: The system to have ability to report on the integrity of all network assigned devices, circuits and communications and provide a diagnostics screen showing field level communications system wide
13. Lock/Unlock Commands: The system to allow an operator to manually lock and unlock doors overriding scheduled access control restrictions and configurations if necessary.
14. Hardware Interface: The system to integrate with and control specified electrified hardware, signaling and monitoring devices.
15. Report Generator: The system to have the ability to generate and output reports with any and all combinations of system fields and data including, but not limited to: by cardholder, by door, by site, by time, by groups of doors and by cardholder field. Any and all combinations of fields must be available for reporting. The report feature to allow exporting of generated reports over a network connection or by remote printing.
16. Multi-User/Web Based Network Capabilities: The system to support multiple operator workstations via local area network/wide area network (LAN/WAN), the Internet, or VPN. The system to be capable of supporting minimum of concurrent users/clients with software expansions to an unlimited number of workstations based on the Owners network requirements.
17. Systems Integration: The system to have the ability to be fully and seamlessly integrated with existing or specified IDS and VMS.

B. Open Architecture: The access control system infrastructure will be based on an open architecture design capable of supporting multiple access control hardware manufacturers and integrate with multiple non-proprietary network processors, controllers, interface modules, integrated locking hardware, remote card readers, keypads and display terminals, and other third party applications.

C. Open Protocol: The ACS manufacturer to provide non-proprietary, open protocol hardware for the system control processors and associated device sub-controllers. Systems utilizing a single manufacturer solution that encompasses combined proprietary software and integrated electronic hardware combinations are not acceptable. In addition, integrated electronic locking hardware requiring a processor or sub-controller module upgrade, or extensive access control firmware upgrades to accommodate integrating with an alternate software package, will not be considered.

D. Network Support: Communication network connecting the central server host software modules, client workstation software applications, and hardware controllers to be designed to support all of the following:
1. LAN/Ethernet enterprise ring topology and localized star topology based on TCP/IP.
2. Direct-connected RS-232 and RS-485 communication cabling.
3. Dial-up modem connection using a standard dial-up telephone line.

E. Provide local communication port at each panel for local configuration of system with laptop.

F. Locate all main control panels in MDF and IDF rooms of each building.

G. Provide 120v at all controller and power supply locations; provide power from emergency power system if available at facility.

H. Provide and transfer all required licensing to the owner.

I. Provide local communication port at each panel for local configuration of system with laptop.

J. Provide and install all software and/or hardwire connections required to connect the system to IDS and VMS.

K. Integrated Elevator Destination Dispatch Control Solutions
1. The ACS shall provide means of integration with the following elevator systems destination dispatch control solution. Integration shall be by software or input/output connection (software, if available between the specified ASC and Elevator System):
   a. Otis
   b. Krone
   c. Thyssen-Krupp
2. The destination dispatch control solution shall provide the following functions:
   a. Provide card reader security within the elevator(s) as required.
   b. Provide card reader security at the Destination Dispatch kiosk(s), as required.
   c. Allow Default Floor call registration upon card swipe.
   d. Allow for card flags such as VIP and ADA from a card swipe
   e. Enforce elevator access levels

L. Integrated Intelligent Locks:
1. Refer to Div. 8

M. Integrated Video Management Systems
1. The ACS shall support integration of DVR and/or NVRs from the following manufacturer. Integration to be completed by the system installer:
   a. Milestone XProtect

2.4 ACCESS CONTROL PANEL HARDWARE

A. Enclosure / Power Supply:
1. Typical 8-Door System Enclosure:
   a. Power supply board 150W, 4A/24V | Secondary voltage power supply, 4A/12V, class 2 power limited output | Eight auxiliary outputs class 2 power limited at 2.5A per output | Eight relayed managed outputs, fused at 3A per output | Four port network monitoring module | Enclosure, (20W x 24H x 6.5D) with Mercury backplate
   b. FPO150-B1002D8PM8NL4E4M/P8-A or latest equal model
2. Provide, install, and configure Enterprise level management software. The management software shall be configured to:

a. Allow central management of multiple network managed power systems.
b. Allow the user to connect any network connected power within a local network or via the internet from any remote location.
c. Allow for all connected power supplies to be monitored for status and firmware revision on a single screen.
d. Allow batch firmware updates to maintain the latest feature sets and cybersecurity standards.

C. System Control Processor (Controller)
1. Intelligent two portal two reader combination system controller with 10/100Base-T Ethernet connectivity and dual reader interface module, minimum of 6MB RAM, 1 RS-232/485 host port, with a secondary RS-232/485 host port for redundancy, 1 two wire RS-485 channel for communication to a maximum of 31 I/O modules, support for up to two magstripe or Wiegand readers. Includes a minimum of two (2) door contacts, two (2) request to exit inputs, two (2) door strike relays, four (4) programmable inputs and two (2) output relays
2. SSP-D2

D. Door Controllers (sub-controller)
1. Two Portal Two Reader interface module - support for up to two magstripe or Wiegand readers. Includes: two door contacts, two requests to exit inputs, two door strike relays, four programmable inputs and four output relays
2. MR52-S3 or latest equal model

E. Input Monitor Modules
1. 16 normally open or closed, supervised or non-supervised inputs for monitoring vital alarm points or for providing elevator floor selection control. Includes: 2 programmable output relays and (32) 1K ohm resisters for supervisory wiring
2. MR16IN-S3

F. Output Control Modules
1. 16 programmable output relays with the option of being configured as fail-safe or fail-secure. These relays support "On", "Off" or "Pulse" modes for a variety of applications such as elevator control or any device requiring dry contacts.
2. MR16OUT-S3

G. System Back-Up Battery
1. Contractor to backup batteries as required to furnish ninety (90) minutes of run time to the complete system, including but not limited to lock power and system power.

H. RS-485 Communications Multiplexer:
1. Provide a multiplexer at each control board that is utilizing a RS-485 communication channel to panel interface modules and/or RS-485 type door hardware. There shall be no more than eight (8) RS-485 connections made on a

2.5 FIELD DEVICES

A. General: Coordinate with door hardware and access control schedule. Provide all Controllers, Sub-Controllers, and licensing as required to connect all card reader locations shown on plan.

B. Card Readers

1. Provided by Division 8

C. Credentials
1. Provided by Division 8

D. Miscellaneous Devices:
1. DP/DT Door Position Sensors (Door Contacts) – Provided by Division 8
2. Door Release Buttons – Provided by Division 8
3. PIR REX – Provided by Division 8

2.6 WIRING

A. Cabling shall be provided and installed by the Access Control System contractor.

B. Conventional access control cable shall be a yellow jacketed composite cable. The minimum conductor requirement shall be as follows:
1. Standard distance up to 499 feet
   a. Lock Power: 4-conductor, 18AWG, shielded
   b. Card Reader: 6-conductor, 22AWG, OA shielded
   c. Door Contact: 2-conductor, 22AWG, shielded
   d. Request to Exit/Spare: 4-conductor, 22AWG, shielded
2. Extended Distance 500 foot and over
   a. Lock Power: 4-conductor, 16AWG, shielded
   b. Card Reader: 6-conductor, 18AWG, OA shielded
   c. Door Contact: 2-conductor, 18AWG, shielded
   d. Request to Exit/Spare: 4-conductor, 18AWG, shielded

C. Wire scheme and conductor quantity shall be as required by the manufacture's specifications. Contractor to provide and install shielded cable as required.

D. All network data cabling to be provided by Div. 27 Structured Cabling contractor. Security contractor to coordinate and communicate network cabling requirements with general contractor in advance of cabling installation, in written form, showing locations and quantities necessary to connect all networked ACS equipment.

D. All 120v Power shall be furnished by the Division 26 contractor. In the event that a division 26 contractor is not contracted for the project, the system installing contractor shall contract a licensed electrical firm to provide and install all materials required to furnish a complete and operational system.

E. All Security Conduit as required for a complete installation of this system shall be furnished by the division 26 contractor as part of their scope of work. In the event that a division 26 contractor is not contracted for the project, the system installing contractor shall provide and install all conduit required.

F. Coordination with the Division 26 contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.

G. All systems shall be connected to a dedicated circuit and on an emergency power source if available.

PART 3 - EXECUTION

3.1.1 INSTALLATION

Provide and install a power supply panel, power supply, and controller (LP1502) in MDF and IDF as required to provide connections to doors.

A. Provide and install a power supply panel, power supply boards, controller and sub-controllers (as necessary) in each MDF and IDF. Connect each NL4 and LP1502 to the campus network.

B. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

C. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 if so, approved by the local authority having jurisdiction.

D. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

E. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.

F. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

G. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

H. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

I. Cable shall be run continuously from controllers to terminal cabinets above each door. No splices allowed.

J. Network Connection Cable: Provide 4-pair Category 6 data cables for LSP and SSP-D2 (LP1502) controllers in each MDF/IDF. Category 6 cable shall be yellow in color.

K. All plenum wiring is to be installed parallel and perpendicular to the building structure. Install wiring tight up against structure for protection. Cable shall be bundled on a maximum of 2'-6" and secured to the structure at a maximum of 5' on center. Bundling and support shall be with plenum rated cable ties.

L. Contractor is required to provide all graphic user interface mapping and software configuration required to operate system as per manufacturer’s recommendations. Provide full scale integration of VMS into ACS software.

M. Minimum 3 foot of slack shall be left at both ends of the run. Neatly coil, dress, and strap slack above accessible ceiling.

3.2 CABLE PATHWAYS

A. Cable Support:
1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
   a. Approved Cable Support Product:
      1) Panduit
      2) Arlington
      3) Caddy
      4) Support system shall be sized appropriately for the number of wires being installed. Reference the manufacturer's specifications for the suggested maximum cables per support size.
2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the J-MOD™ support hook to the treaded rod.
3. J-MOD™ cable support shall be installed at a maximum of 5' on center.
4. All cable installed shall be attached to the J-MOD™ support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each J-MOD™ cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building's steel or supported in any other method than that stated above.
6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.

B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.
5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

3.3 TESTING

A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner and the project's Technology Consultant and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner

prior to substantial completion.

B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.4 WARRANTY

A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

3.5 SOFTWARE

A. Provide two electronic copies of the final programming and program software to the Owner’s Security Supervisor after final approval.

END OF SECTION 28 10 00

SECTION 28 15 00 INTRUSION DETECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED WORK

A. The following sections shall associate with this specification as applicable.
1. General Conditions
2. Supplementary Conditions
3. Division 1
4. Division 26 in its entirety.
5. Division 27 in its entirety.
6. Division 28 in its entirety.

1.2 WORK INCLUDED

A. The Contractor shall furnish and install a complete microprocessor based Intrusion Detection System (IDS) as specified herein. The IDS shall include, but not be limited to, all control equipment, power supplies, power circuits, signal initiating and signaling devices, conduit, wire, fittings, and all other accessories required to provide a complete and operable system.

B. IDS devices indicated are for reference and coordination purposes only. The installing contractor shall design and provide a complete system, meeting the requirement of specification,. The Contractor shall provide all security system devices required for complete system perimeter coverage acceptable to all governing authorities, Architect and Owner.

C. The IDS shall include security for all access points into the building(s), including but not limited to doors, roof hatches, windows and interior space motion detection.
1. The IDF shall be the product of a single manufacturer.
2. Tag all conductors or cables at each end.
3. Installation of IDS panels.
4. Interconnection of IDS panels.
5. Installation of new IDS devices.
6. Full coverage of all windows, doors, roof hatches.
7. Preconstruction meeting with Owner’s personnel, installing technician and project superintendent.

D. The contractor shall connect this location to the district monitoring station as designated by the owner.

1.3 CODES AND STANDARDS

The system shall comply with the applicable Codes and Standards as follows:

A. National Electric Code, Article 760.

B. National Fire Alarm Code (NFPA 72).

C. Life Safety Code (NFPA 101)

D. Administrative Council for Terminal Attachments (ACTA):
1. ANSI/TIA-968-A-2002 Technical Requirements for Connection of Terminal Equipment to the Telephone Network.

E. American National Standards Institute (ANSI):
1. ANSI C63.4 Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

F. California State Fire Marshal (CSFM):
1. Title 19, California Code of Regulations, Building Material Listing Program (BML).

G. Federal Communications Commission (FCC):
1. Title 47 C.F.R. Part 15; Class B – Radiated and Conducted Emissions.
2. Title 47 C.F.R. Part 68; rules governing the connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN).

H. The National Institute of Standards and Technology of the United States of America (NIST):
1. Federal Information Processing Standards Publications 197 (FIPS 197) –Advanced Encryption Standard (AES).

I. International Organization For Standardization (ISO):
1. 9001 - Quality System.

J. Underwriters Laboratories, Inc. (UL):
1. UL 50 - Enclosures for Electrical Equipment.
2. UL 294 – Access Control System Units.
3. UL 365 - Police Station Connected Burglar Alarm Units and Systems.
4. UL 609 - Local Burglar Alarm Units and Systems.
5. UL 864 - Control Units System for Fire-Protective Signaling System.
6. UL 985 - Household Fire Warning System Units.
7. UL 1023 - Household Burglar Alarm System Units.
8. UL 1076 – Proprietary Burglar Alarm Units and Systems
9. UL 1610 - Central Station Burglar-Alarm Units.
10. UL 60950-1 - Information Technology Equipment - Safety.
11. UL 636 – Hold up alarms

K. Local & State Building Codes

L. Requirements of Local Authorities having Jurisdiction

M. Requirements of American Disabilities Act (Public law 101-336).

N. Texas Accessibility Standards (T.A.S.)

O. State Fire Marshall.

P. Texas Insurance Code.

1.4 QUALITY ASSURANCE

A. Contractor Qualifications:
1. The installing contractor shall be the authorized representative of the IDS authorized/certified to sell, install, and service the proposed manufacturer's equipment. The installing contractor shall have represented the IDS manufacturer's product for at least five (5) years.
2. The installing contractor shall be certified to install and setup the IDS software with Security Engine and Access Engine Modules attached.
3. The installing contractor shall be licensed by the State of Texas as a security services contractor to design, sell, install, and service security alarm systems and

access control system.

4. The installing contractor shall provide 24 hour, 365 day per year emergency service with factory trained service technicians.
5. The installing contractor shall have personnel on their staff that has been actively engaged in the business of designing, selling, installing, and servicing security alarm systems for at least ten (10) years.
6. All Contractors must submit to the owner prior to starting any work the factory training certificates for all personnel that will be working on the specified IDS. No person is allowed to work on the IDS without proper manufacturer's certification.

1.5 SUBMITTALS

A. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
   1. Control panel wiring and interconnection schematics.
   2. Complete point to point wiring diagrams.
   3. Riser diagrams.
   4. Complete floor plan drawings locating all system devices.
   5. Factory data sheets on each piece of equipment proposed.
   6. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
   7. Complete system bill of material.
   8. Line by line specification review stating compliance or deviation.

B. All submittal data will be in bound form with Contractor's name, supplier's name, project name, and state security license number adequately identified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND INSTALLERS

A. Acceptable Manufacturer: Bosch Security Systems, Inc.; 130 Perinton Parkway; Fairport, NY 14450. ASD. Toll Free Tel: 800-289-0096. Tel: 585-223-4060. Email: request info (presales.support@us.bosch.com). Web: www.boschsecurity.us.

B. Substitutions: Not permitted.

C. Requests for substitutions will be considered in accordance with provisions of Division 0.

2.2 CONTROL COMMUNICATOR (Panel)

A. The DACS control panel shall be Bosch Security Systems, Inc. model B9512G comprising a fully integrated intrusion and residential fire control system. The control panel shall support the following:
   1. The DACS system is capable of being utilized as a combination Intrusion and Commercial Fire system per code. Fully integrated intrusion and fire functions allow users to interface with 1 system instead of 2.
   2. Optional Telephone Line Module, programmable for signaling and supervision.32 programmable areas with perimeter and interior partitioning.
   3. Integrated Conettix IP based communication provides high-speed, secure alarm transport and control.
   4. 32 programmable areas with perimeter and interior partitioning.
   5. 8 on-board, hardwired points with expansion capability for a total of 599 using a combination of wired or wireless points.
   6. Compatibility with Color Graphic Touch Screen, 2-line alpha numeric capacitive touch, ATM style LCD or 2-line LCD style Alarm Keypads

7. Local or remote programming, test, and diagnostic capability via a computer running the Remote Programming Software (RPS).
8. The system shall support the use of an Apple iOS device and/or Android device for control. Functions to include arming, disarming and control of outputs and access door, viewing of connected IP cameras. This application shall connect directly to the DACS using internet, wifi or cellular communications and shall not require a third party server of network operations center (noc).
9. The DACS will allow integration with up to 16 Bosch IP video cameras using the built-in Ethernet connection, allowing the cameras to act as inputs and outputs.
10. The DACS shall support integration with the Bosch Video Management System (BVMS) using the built-in Ethernet adapter.
11. The DACS shall support up to thirty-two (32) custom functions allowing the installer to combine up to 6 functions into one command. These custom functions shall be operated by keypad command, point activation, keyfob button, or programmable schedule
12. The DACS shall support up to 32 keypad shortcuts which allow the installer to define which commands are available at each keypad.
13. The system shall offer multiple language support that can be assigned per keypad. Languages supported must include English, Latin American Spanish, Portuguese and/or Canadian French.
14. The DACS shall support flash firmware upgrades of systems firmware for the control panel and peripherals, allowing for future updates.
15. Integrated real time clock, calendar, test timer and programmable scheduling capability for relay control and automatic execution of system functions based on a time / event.
16. Provide 1.4 amps of power for standby operation and 2.0 amps of alarm power, both rated at 12 VDC.
17. 3 configurable form ‘C’ wet or dry-contact relay outputs with expansion capability for up to an additional 472 dry-contact relay outputs.
18. Integrated battery charger with reverse hook up protection, battery supervision and battery deep discharge protection.
19. Supervision of peripheral devices and communications interface(s).

B. Point Functionality and Expansion:
1. Each point in the system shall be programmable to provide the following type of response in the system:
    a. Always on (24 hour response).
    b. On when the system is Master Armed.
    c. Only on when the system is Perimeter Armed.
    d. Displays / Does Not Display at the ACC when the point is activated.
    e. Provides / Does Not Provide entry warning tone.
    f. Sounds / Does Not Sound audible alarm indication.
    g. The Point is bypassable / not bypassable.
    h. Alarm Verification with programmable verification time.
    i. Fire Alarm Point
    j. Relay activation by Point.
    k. Provides / Does Not Provide "watch point" capability.
    l. Provides Swinger Bypass.
    m. Defers Bypass Report.
    n. Can return to the system after being force armed and then restoring.
    o. Can return to the system after being bypassed and then restoring.
    p. Keyswitch arming (maintained or momentary)
    q. Activate by Custom Function
    r. Activate following an output
    s. Gas Alarm

2. The system shall support a programmable Monitor delay functionality for supervision of points during disarmed periods. These points may be programmed to ignore status from 1 to 60 minutes and will activate only if the point is off-normal for this time period.
3. The system shall support a programmable delay response functionality for supervision of points during armed or disarmed periods. These points may be programmed to ignore status from 1 to 60 minutes and will activate only if the point is off-normal for this time period.
4. The system shall support virtual points and outputs for customized programming of events
5. The DACS shall be capable of supporting "group zoning." Group zoning refers to the combining of points into a separately identifiable and separately annunciated (programmable text) areas.
6. The DACS shall be capable of allowing variable point response times via programming. Point response times shall be programmable over a range of 300 milliseconds to 4.5 seconds.
7. The DACS shall have the capability to expand up to 599 separately identifiable points, of which 8 are on-board and 472 are off-board wired, addressable or wireless points.
    a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
    b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.
    c. Addressable modules shall be able to be located remote to the panel to a maximum of 500 feet.
8. The DACS shall have the capability to expand up to 99 separately identifiable points, of which 8 are on-board and 91 are off-board addressable points connected to multiplexed backbone trunks via wired modules and/or wireless receivers.
    a. The 8 on-board points shall be able to accommodate powered class B functionality using a powered loop interface module.
    b. Point Expansion Modules (Wired and Wireless) shall be able to be located remote to the main panel to a maximum distance of 1000 feet.
    c. Addressable modules shall be able to be located remote to the panel to a maximum of 500 feet.

C. Areas/Accounts:
1. The DACS shall support 32 independent areas. Each of the 32 areas shall have custom text associated with the armed state, disarmed state and point-off-normal state.
2. The DACS shall be capable of assigning 1 to 4 account identifiers to the areas depending on the distribution of areas per account.
3. The DACS shall be capable of assigning 1 to 2 account identifiers to the areas depending on the distribution of areas per account.
4. All of the areas must be capable of Master (All) and/or Perimeter (Part) arming (excluding predefined Interior protection).
5. The DACS shall be capable of logically grouping 1 or more points into an area, or conversely, dividing 2 or more points into two or more areas.
6. Any area shall be configurable to allow arming by specific users when a programmable number of devices are faulted or bypassed.
7. Areas shall be independently controlled by their corresponding ACC.
8. Area(s) shall accommodate assignment of independent account numbers to define annunciation, control, and reporting functions.
9. The DACS shall be capable of linking multiple areas to a shared area which may be automatically controlled (hallway or lobby).
10. The DACS shall accommodate conditional area arming dependant on the state of

other areas (master or associate). Any area can be configured for perimeter and interior arming, not requiring a separate area for this function.

D. Output Relay Expansion: The DACS shall provide the capability for output relay expansion using relay expansion modules. Independent control of relay functions by area shall be possible through programming assignments.
   1. The DACS shall be capable of activating 472 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module.
   2. The DACS shall be capable of activating 64 additional relay outputs for auxiliary functions based on its classifications (area vs. panel wide). Output Expansion Modules shall be able to be located remote to the main panel to a maximum distance of 1000 feet. 8 relays (Form C) are to be provided per octo-relay module
   3. The DACS shall be capable of controlling relays and automatically executing system functions based on a time / event scheduling program. The program can be hour, day of week or day of month based.
   4. Relays and other outputs may be programmed to follow up to 14 different area conditions or up to 12 panel conditions. Relays may also be programmed to follow individual points or groups of points.
   5. The DACS shall support 5 different types of alarm output selections: Steady, Pulsed, California Standard, Temporal Code 3 and Temporal Code 4.

E. Scheduling: The DACS shall support scheduling capabilities with the following characteristics:
   1. Arm / Disarm specific area(s) based on open/close windows.
   2. Bypass / Unbypass point(s).
   3. Activate / Deactivate relay(s).
   4. Send test reports.
   5. Up to 4 programmable holiday schedules of 366 days each (includes leap year). Based on the holiday settings, different time windows for open/close and other system functions can be executed.
   6. Automatic adjustment of system clock for daylight savings time.

F. Alarm Keypads:
   1. The DACS shall accommodate connection with up to 32 ACCs, each capable of displaying custom English, Latin American Spanish, Portuguese or Canadian French text on a liquid crystal display.
   2. The Alarm Keypads shall accommodate viewing and configuration of system parameters including:
      a. Network Parameters:
         1) DHCP Enable/Disable for the selected network module.
         2) UPnP Enable/Disable for the selected network module.
         3) IP Address for the selected network module
         4) Subnet Mask for the selected network module.
         5) Default Gateway for the selected network module.
         6) Port Number for the selected network module - The module's port number shall range from 0 to 65,535.
         7) DNS Server Address for the selected module's DNS server IP address
         8) DNS Host Name for the selected module. The DNS host name shall contain up to 63 characters.
         9) AES Encryption Key Size – Enable/Disable encryption by selecting the AES encryption key size for the selected network module.
         10) AES Encryption Key String - The user shall be able to display, add

and modify the AES encryption string based upon the key size previously configured for the selected network module.

b. Point Parameters:
   1) Point Selection between one and the maximum number of points in the control panel.
   2) Point Registration to allow system response from a specific physical point on any one of the expansion modules; On-board or Point expansion modules (wired or wireless)
   3) Wireless points shall be able to be enrolled in the system via an auto enrollment feature.
   c. Event Routing Parameters to allow programming of up to 4 report routing groups as well as configuration of primary and secondary paths.

G. User Passcodes and Authority: Passcodes shall be programmable with authority levels to allow users to operate any or all areas.
   1. Up to 2000 different passcodes shall be accommodated
   2. Up to 500 different passcodes shall be accommodated.
   3. Each passcode shall be 3 to 6 digits (variable) and be assigned a 32-character user name
   4. User access to System features and functions shall be configurable based on 14 individually programmable levels of authority assigned to the user passcode. Additionally, the system shall have the capability to assign to the user passcode, a different authority level in each of the areas. A service passcode can be assigned to the servicing agent allowing the agent limited access to system functions. User-programmable / activated functions include:
      a. Arming the system: All areas, specific area(s) only, perimeter instant, perimeter delayed, perimeter partial, watch mode, and arming the system with a duress passcode.
      b. Disarming the system: All areas, specific area(s) only and disarming with a duress passcode.
      c. Viewing system status: Faulted points, event memory, bypassed points, area status and point status.
      d. Implementation functions: Bypass a point, unbypass a point, reset sensors, silence bell, activating relays, initiating the remote programming function locally to allow programming the system from a remote location.
      e. Testing the system: Local Walk test, Service Walk test, Fire test, send report to remote DACR to check the telephone link, and programming the time and date for the next test report transmission.
      f. Change system parameters: ACC display brightness, system time and date, and add/delete/change passcodes.
      g. Extend the closing time of the system.
      h. Transmitting special alerts and activating audible and visible signals.
      i. Executing multiple commands / ACC keystrokes from a single Menu / Command List item. This function shall be able to have a 32 character (alphanumeric) title to identify it on the ACC display.
      j. Editing of time / event based scheduling program from the ACC.
      k. The DACS shall also provide a "service menu" to implement functions such as viewing and printing the system log, displaying the system firmware revision number, and defaulting (toggling) text displays between custom and default text displays for troubleshooting.
   5. The DACS shall allow users to change their own user passcode from the Alarm Keypad (ACC). Managers shall be capable of changing the user passcodes and authority assignments by area of other users from the ACC.
   6. The DACS shall incorporate a programmable "Passcode Follows Scope" feature to

allow users to arm or disarm only the area they are entering with one simple command or control all areas from one ACC.

H. Communication: The DACS shall be capable of reporting system events and supervisory reports including alarm, trouble, missing modules, restorals, system status, AC failure, battery status to primary and secondary off-site DACR's. The following features shall be supported.

1. The DACS shall be capable of communicating via dial-up analog telephone lines, over a LAN/WAN/Internet using a wired network interface module, or over a cellular network using a CDMA Cellular interface module. The installed system will require B430 phone line module.
2. The Bosch Modem4 communications format shall be utilized for optimum system performance. The Modem4 format provides the maximum data information to the receiver for alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. The detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information. As an alternative format, Contact ID may be used although it will include less detailed information like point or user text.
3. The DACS shall be capable of sending text (SMS) messages to compatible devices without requiring that these message are sent to a monitoring center
4. The DACS shall have the capability of communicating with up to 8 different DACRs using up to 4 different phone numbers, up to 24-digits in length and/or 4 URL/IP addresses over a network.
5. The DACS shall report to a Commercial Central Station that is using a Bosch D6600 Receiver/Gateway or a Bosch D6100i Receiver using Modem4 as a preferred format or Contact ID as an alternate format.
6. The DACR shall provide the transmission information sent from the DACS that includes alarms, troubles, restorals, bypasses, relay activation, opening/closings, and card access. When using the ModemIIIa² format the detailed information includes the point numbers with text, peripheral device numbers, user numbers with text, and area information.
7. The DACS reports shall be classified, by event, into eleven subcategories or "report groups." Each group represents similar types of events. Individual events within each group shall be selectively enabled or disabled for transmission. The eleven report groups shall be as follows:
   a. Fire Reports.
   b. Burglar Reports.
   c. User Reports.
   d. Test Reports.
   e. Diagnostic Reports.
   f. Relay Reports.
   g. Auto Function Reports.
   h. RPS Reports.
   i. Point Reports.
   j. User Change Reports.
   k. Access Reports.
8. The DACS shall have the capability to verify the integrity of the remote communications path and switch to alternate paths when a communications failure occurs.
9. The DACS shall be capable of unattended mode of operation whereby programming and configuration updates are automatically transferred using the Remote Programming Software (RPS). These updates can initiate from either the control panel or the remote computer using RPS.

I. Network Communication: The DACS shall be capable of network communications over a

LAN, WAN, Intranet, or the Internet. The system shall include supervision of the network communication utilizing configurable periodic heartbeats to the Digital Alarm Communications Receiver (DACR). The DACR shall provide notification of the loss of communications from a networked system after a programmable timeframe since the last communication. The notification options shall be programmable and include local annunciation or indication to automation software.

1. The network interface module shall be capable of supporting Dynamic Host Communication Protocol (DHCP) to obtain an IP Address.
2. The system shall support a method of authentication between the control panel and the receiver to ensure that the control panel has not been compromised or replaced.
3. The network interface modules shall be capable of supporting encryption using a minimum of 256-bit AES Encryption (Rijndael) certified by NIST (National Institute of Standards and Technology) utilizing the Cipher Block Chaining (CBC) method.
4. The network interface module shall support a 10/100BaseT connection to an Ethernet network.
5. The control panel shall be capable of network communication with a programmable poll time to send periodic heartbeats to the receiver, programmable ACK Wait time, and programmable retry time. In the situation where a communication path is unsuccessful, the control panel shall be capable of attempting backup communication through an available communication method to the same receiver or a backup receiver.
    a. The control panel shall have the ability to automatically adjust the heartbeat rate of a backup path that is using cellular to the heartbeat rate of the primary path in case of a primary path failure. Upon restoral of the primary path, the heartbeat rate of the backup path shall automatically restore to the original rate. This allows a system utilizing cellular communications to keep the wireless charges low.
    b. The network communication between the control panel and the receiver shall use Modem4 or Contact ID.
    c. The control panel shall be capable of two-way communication using a wired network interface module with a 10/100BaseT on a LAN/WAN/Internet configuration or with a cellular module on the Internet.
    d. The control panel shall be capable of configuring the destination of the receiver using a URL or static IP Address.
    e. The control panel shall be capable of using DNS to lookup the IP Address of the receiver when programmed with a URL.
    f. The control panel shall support UPnP for automated Port Forward configuration in the router where the control panel is installed.
    g. The control panel shall support AutoIP to enable the RPS software to connect to the control panel locally using an IP Direct connection.
    h. The control panel shall support configuration of the IP parameters from the keypad eliminating the need for a PC to configure the IP device.
    i. The control panel shall support network diagnostics from a keypad to allow local testing of network connectivity. The diagnostics should include, Ethernet cable connected, gateway configuration ok, DNS lookup operational, and external network connectivity (such as the Internet) operational.
    j. The system shall be capable of meeting DCID 6/9 and UL 2050 standards.

J. Event Log: The DACS shall maintain a log of events indicating time, day, month, year type of event, account number, area number, user ID, point text, user text and primary/secondary event route. The system shall allow the following characteristics:

1. The DACS shall be capable of storing up to 10,000 events
2. The DACS shall support viewing of logs locally at the ACC and remotely via an upload to a remote central station computer running the RPS software.

3. The DACS shall provide notification via a report to the DACR when the event log reaches a programmable “percent full capacity". This allows retrieval of stored events via RPS to prevent any loss of event history.
4. Group, signal type and area can route events to specific receivers.
5. Each DACR shall be designated as a primary, backup, or duplicate destination for each report group. Assigning an event to multiple routing groups provides for duplicate destinations for the event. The transmission of grouped events allows the reporting of different types of information to different remote DACRs.

K. Testing, Diagnostic, and Programming Facilities: The DACS shall be capable of sending (manually or automatically) test and status reports to remote DACRs.
1. The DACS shall be capable of sending automatic tests daily, weekly or once every 28 days. Automatic test times shall be programmable to provide an offset of up to 24 hours from the current time.
2. Automatic test reports shall be programmable to be deferred by one test interval if any other report is transmitted in the current interval.
3. Automatic test reports and remote system access for diagnostics shall be supported via a remote central station computer with Remote Programming Software (RPS).
4. The DACS shall be programmable locally or remotely. Programming shall be accomplished via a Keypad or a computer with a remote programmer and diagnostic software package (RPS).
5. The DACS shall allow an on-site user to initiate remote programming while on-line with the servicing location. The remote programming device must provide a compare feature and allow for downloading either the stored program or the (un)modified program copied from the panel.
6. The DACS shall allow the local programming option to be disabled and must provide a method to program a panel while no one is on premises, when the panel shares a line with an answering machine.
7. The DACS shall accommodate IP Diagnostic to verify settings and operation of the network interface modules; Host name, MAC address, IPV4 address assignment. The IP Connection test shall include; Link test to verify physical cable integrity, Ping test to verify gateway response, ping test to verify address on the internet.
8. Wireless point diagnostics shall include signal strength and device states of registered wireless points in the system.
9. The number of system testing and programming sessions shall be restricted via the use of program locking features and passwords. Passcode protection in excess of sixteen million combinations is required.
10. New modules support enhanced diagnostics through RPS.

L. Miscellaneous Features: Programmable alarm output timer, 4 programmable entry delay times, exit delay programmable by area, individually programmable point of protection text, point bypassing, key switch arming capability with LED outputs, and fire verification.

M. False Alarm Reduction: The DACS shall comply with all ANSI SIA CP-01 2010 requirements for false alarm reduction.

N. Ambush Detection: The DACS shall include an early ambush feature that requires that the user disarm, and then inspect the facility within a specified time period, before entering their passcode or a different authorized passcode again. If the user does not enter a passcode a second time, a duress event is generated. If the user does enter a passcode within the specified time period, the system disarms.

O. Two man rule: The DACS shall include a programmable feature that requires 2 separate passcodes to be entered to disarm the system. After 1 passcode is entered, the system will prompt for a second passcode to be entered on the same ACC. Without the second

passcode, the system shall not disarm.

P. Dual Authentication: The DACS shall support Dual Authentication by area. Areas programmed for Dual Authentication require activate of a card and a passcode to allow access to system functions, arm/disarm, or access control doors.

Q. Area Re-Arm: The System shall support programmable area re-arm time of 1 minute to 24 hour.

R. User-Programmable Features: The DACS shall provide a menu driven interface to provide a user-friendly command structure for programming / customizing the system to the operational criteria of the application. The DACS shall be capable of being operated via:
1. The Command Structure.
2. Menu / Command List.

S. Command centers shall be microprocessor-based, UL listed, with built in: Model D1255 White Alpha IV Command Center.
1. 16 character illuminated alpha-numeric display.
2. Burglary and fire sounders.
3. Backlight 15-key touchpad.
4. Pre-warn tone.
5. The arming station shall have the ability to annunciate the English language format via the 16 character alphanumeric display by the following:
   a. Master zone (alarm, service, faulted, and function), POPIT (alarm, service, faulted, missing, extra, function, and location), arm/disarm status (system diagnostics, time/day/date, and user prompts).
6. Additional features shall include local system test, sensor reset, panic and/or medical and/or duress alarm initiation, independent master zone by-pass with automatic restoration to normal status to next system arming, perimeter watch mode, user changeable pass codes, remote programming initiation, and system/monitoring service test.
7. Radionics model B920 2 line keypad, and shall be functional at each of the locations shown on the floor plans.

T. Modules and Accessories (as Required)
1. ZONEX (Zone Expansion B299)
2. B208 Octo Input module
3. B308 Octo output module
4. B426 Ethernet module.
5. Auxiliary power supplies as required for powering of motion detectors.
6. D9127U and D9127T POPIT.
7. B430 Phone Line module (Required).

2.3 FIELD DEVICES

A. Ceiling mounted, 360-degree dual technology, infrared sensors/microwave motion sensors. Model DS 9370.
1. Bracket for direct mounting to standard 3-1/2" and 4" electrical backboxes.
2. All units to have areas of coverage, which would cause false alarm signals to be generated, masked out and adjusted to reduce false signals.
3. Contractor to provide a dedicated POPIT for each motion detector on the project.

B. Wall mounted, high performance, TriTech PIR/Microwave sensor, Model DS970.
1. Low Profile Bracket for directional mounting to standard 3-1/2” and 4” electrical backboxes.

2. All units to have areas of coverage, which would cause false alarm signals to be generated, masked out and adjusted to reduce false signals.
3. Provide in gymnasiums/cafeteria wall mounted areas. Provide protective wire cover in gymnasium areas.
4. Contractor to provide a dedicated POPIT for each motion detector on the project.

C. Magnetic Door/Hatch Contacts MODEL Sentrol 2500 Series 2505L
1. Where exposed contacts are used, they shall be heavy duty switches protected by die cast aluminum housing. The contact leads shall be encased in steel armor jacket.
2. Magnetic Door/Hatch Contacts MODEL Sentrol 2505A door contact
3. Contractor to provide a dedicated POPIT for each motion detector on the project.

D. Glass Break Detector
1. Bracket for direct mounting to standard 3-1/2” and 4” electrical backboxes.
2. Protective wire cage as required in areas where damage to detectors is possible such as athletic corridors, gymnasiums, activity centers, kitchens, etc.
3. GE Solution 2000.

2.4 WIRING

A. All wiring shall be by the manufactures (Bosch/Radionics) specifications. All cable shall be shielded as required.

B. All 120v Power shall be furnished by the Division 26 contractor.

C. All Security Conduit as show on the drawings shall be furnished by the division 26 contractor as part of there scope of work.

D. Coordination with the Division 26 contractor is the responsibility of the Security Contractor to ensure all conduit is in place for a complete installation.

E. All systems shall be connected to an emergency power source as available.

F. Color code of all security intrusion detection system and access control wiring shall be purple in color.
Approved Products:
1. 18/2 unshielded:
Belden #6300UE 0071000
Tappan Wire & Cable, Inc. #P40020.122
2. 18/4 unshielded:
Belden #6302UE 0071000
Tappan Wire & Cable, Inc. #P41387.28

PART 3 - EXECUTION

3.1 INSTALLATION

A. All wiring shall be in accordance with the National Electrical Code, Local Codes, and article 760 of NFPA Standard 70. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

B. All wire shall be UL Listed CL2 for limited energy (300V) applications and shall be installed in conduit. Limited energy MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon

type and complies with NEC Article 760 if so approved by the local authority having jurisdiction.

C. No AC wiring or any other wiring shall be run in the same conduit as security alarm wiring.

D. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.

E. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.

F. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

G. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

H. Telephone Cable: Provide a 4 pair Category 5E telephone cable from the Master Control Panel to the Telephone Equipment Room.

I. Each motion sensor is to be connected into a dedicated POPIT module for point identification.

J. Each set of magnetic door contacts that protect one room are to be connected through one POPIT module for point identification of that room.

K. Magnetic door contacts protecting separate hallways or entry areas to be connected into separate POPIT modules for separate identification.

L. Provide and install (1) dedicate POPIT for each device installed on the project. Including, but not limited to glass break detectors.

M. All POPIT Modules shall be installed inside a 4”x4” junction box with a cover. Junction box shall be mounted on the wall nearest to the device the POPIT Module is associated with and the module shall be mounted to the mounted to the back box at each location.

N. Integrate the security system to the remote monitoring station. Provide all hardware and cabling as required. Coordinate with Owner for approved remote monitoring service.

O. All popits on project shall be mounted above ceiling in easily accessible area. All popit modules are required to be located on as-built drawings delivered to owner at completion of project.

P. All keypads and sirens shall have dedicated wiring homeruns from each keypad or siren back to panel. Do not daisy chain keypads or sirens.

Q. Contractor shall install communication wire from freezer/cooler control panels to burglar alarm panel to notify panel should freezer/cooler encounter high temperature condition. Coordinate programming and final terminations with Owner.

3.2 CABLE PATHWAYS

A. Cable Support:

1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable support system for the entire run of each cable. Including, but not limited to service loops.
   a. Approved Cable Support Manufacturer:
      Panduit Corporation
      Erico/Caddy
      B-Line
      Supports shall be sized appropriately for the number of wires being supported. Reference the manufacturer's specifications for the suggested maximum cables per support size.
2. The approved cable support system shall be attached directly to the building steel at a serviceable height. In the event that the building steel is not 5' of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5' of the finished ceiling and mount the cable support hook to the treaded rod.
3. J-MOD™ cable support shall be installed at a maximum of 5' on center.
4. All cable installed shall be attached to the cable support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support, to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. ABSOLUTELY NO CABLE, NOT INSTALLED IN CONDUIT, WILL BE ALLOWED TO BE ATTACHED DIRECTLY TO THE BUILDING'S STEEL OR SUPPORTED IN ANY OTHER METHOD THAN THAT STATED ABOVE.
6. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO COORDINATE WITH ALL OTHER TRADES ON THE PROJECT TO ENSURE THAT THE PATHWAY OF THIS SYSTEM DOES NOT INTERFERE WITH THE INSTALLATION OF THE OTHER TRADES AND TO PREVENT THE INSTALLED PRODUCT OF OTHER TRADES FROM PUTTING STRAIN ON THE INSTALLED WIRING.

B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

3.3 SYSTEM OPERATION

A. When an alarm condition is detected by any of the alarm initiating devices, the following functions shall occur:
1. The system keypad's interior audible device shall sound until silenced by using proper security code or after system time out.
2. A custom system alarm message shall be displayed on the LCD display. This display will show the alarm device location in plain English. Location and partition custom messages shall be field programmable.
3. The remote signaling tie connection shall be activated at the Owner's approved central security monitoring location and/or other Owner designated location.
4. Printer shall provide printed copy of events recorded in logger. Install adjacent to security panel.

3.4 SYSTEM ZONING AND PARTITIONING

A. The system shall employ intelligent initiating devices and interface devices capable of being recognized and enunciated at the main system keypad and devices partition keypad.

B. All zoning/device locations shall be field programmable.

C. Input control zones shall be coordinated with the owner prior to final programming:

3.5 TESTING

A. Submit a written test report from an authorized representative of the equipment manufacturer that the system has been 100% tested and approved. Final test shall be witnessed by Owner, Engineer, Electrical Contractor and performed by the equipment supplier. Final test report must be received and acknowledged by the Owner prior to substantial completion.

B. Provide instruction as to proper use and operation of system, for the Owner's designated personnel.

3.6 WARRANTY

A. Entire system shall be warranted against defects in materials and workmanship for a period of one (1) year from the date of substantial completion.

3.7 SOFTWARE

A. Provide two electronic copies of the final programming and program software to the Owner’s Security Supervisor after final approval.

END OF SECTION 28 15 00

SECTION 28 20 00 VIDEO SURVEILLANCE SYSTEM

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Furnish and install IP closed-circuit television system including cameras, mounts, licensing, and system programming.

B. The contractor shall coordinate with other system vendors, where appropriate, to facilitate equipment installation, scheduling, protection of equipment and access to the project site in order to provide the Owner a substantially complete project in a timely manner.

C. Contractor is responsible for coordinating all electrical work required on this project for connection of servers, cameras, conduit, and power supplies. Contractor shall provide a complete solution to the owner and be responsible for the complete installation of the video security camera system. Any additional power requirements for power supplies and additional pathway conduits/sleeves are to be provided by the system installing contractor's licensed electrician or the project's electrical contractor.

D. Contractor will be required to meet with district security representative before any cabling is to be installed to walk the site and coordinate proposed camera locations and cable routing.

E. Data cabling for IP/PoE cameras shall be provided by Division 27 10 00 00.

F. Contractor shall provide a complete installation of camera including testing of all cameras. Testing and camera aiming must be conducted in conjunction with the Owner's Security personnel prior to installation.

G. Locate equipment to accommodate millwork, fixtures, marker boards and other room equipment at no additional cost to the Owner.

1.2 RELATED SECTIONS

A. Division 26 and Division 27

1.3 DEFINITIONS

A. ACS – Access Control System

B. CSA – Client Software Application

C. DGM – Dynamic Graphical Maps

D. DVS – Digital Video Server

E. LPR – License Plate Recognition

F. SDK – Software Development Kit

G. SMA – Software Maintenance Agreement

H. SSM – Server Software Module

I. UI – User Interface

J. VMS – Video Management System

1.4 QUALITY ASSURANCE

A. Installer Qualifications:
1. The contractor shall be licensed and shall meet all applicable regulations. The contractor shall be a firm normally employed in the security industry.
2. The contractor shall be certified by the manufacturing company in all aspects of design, installation and testing of the products described herein. Each contractor shall furnish with their submittal a letter from the manufacturer indicating they are a dealer in good standing.
3. The contractor must be certified by the manufacturer of the products, adhere to the engineering, installation and testing procedures and utilize the authorized manufacturer components and distribution channels.
4. The contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size. The contractor shall own and maintain tools and equipment necessary for successful installation and testing of video surveillance distribution systems and have personnel who are adequately trained in the use of such tools and equipment.
5. A resume of qualifications shall be submitted with the Contractor's proposal indicating the following:
   a. A list of five recently completed projects using the product proposed of similar type and size with contact names and telephone numbers for each.
   b. A list of test equipment proposed for use in verifying the installed integrity of metallic cable systems on this project.
   c. A technical resume of experience for the contractor's Project Manager and on-site installation supervisor who shall be assigned to this project.
   d. A list of technical product training attended by the contractor's personnel that shall install the video surveillance system shall be submitted.
   e. Any subcontractor who shall assist the video surveillance contractor in commissioning / programming of this work shall have the same training and certification as the video surveillance contractor.

B. It is acceptable for a non-certified contractor to furnish and install security cameras. Final licensing, and commissioning / programming shall be performed by VMS manufacturer certified contractor.

C. Contractor must be a current integrator of solution in the Houston/Galveston metropolitan area, have a permanent office located within 150 miles of the project, and be able to include information on current support staff to be able to service this client.

D. The Owner's representative reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

E. Contractor shall schedule a pre-construction meeting with Owner / Engineer to review specific project requirements.

F. The system programmer shall have attended manufacturer training and obtained certification in Milestone xProtect Expert.

G. The system programmer shall be a Milestone certified partner with the following level of qualification: Expert

H. The system programmer shall submit proof of certifications.

1.5 REGULATORY REQUIREMENTS

A. Standards: All work shall be performed in accordance with the latest revisions of the following standards and codes:
1. Local Building Code
2. Local Electrical Code
3. NEC National Electrical Code

B. Other references:
1. TIA/EIA-568-A - Commercial Building Telecommunications Wiring Standard
2. EIA/TIA-569 - Commercial Building Standard for Telecommunications Pathways and Spaces.
3. TIA/EIA-606 - The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
4. TIA/EIA-607 - Commercial Building Grounding and Bonding Requirements for Telecommunications
5. TIA/EIA TSB 67 - Transmission Performance Specification for Field Testing of Unshielded Twisted-Pair Cabling Systems.
6. ISO/IEC 11801 - Generic Cabling Standard
7. EN 50173 - Generic Cabling Standards for Customer Premises

C. Governing Codes and Conflicts: If the requirements of these specifications or the Project Drawings exceed those of the governing codes, regulations, and manufacturer installation requirements, then the requirements of these specifications and the drawings shall govern. However, nothing in the drawings or specifications shall be construed to permit work not conforming to all governing codes, regulations, and manufacturer installation requirements.

1.6 SUBMITTALS

A. Contractor shall meet with Owner’s Security representative prior to submission of formal/final shop drawings to Engineer to allow the Owner and Engineer to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. The contractor shall then submit the final and formal submittal to Engineer for review. After the draft submittal has been reviewed by the Owner / Engineer, and formal shop drawings have been reviewed by Engineer and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Engineer.

B. The video surveillance system installer shall furnish all CCTV system submittals in a single consolidated submittal.

C. Shop Drawings: Submit the following items, for Owner review and approval:
1. Samples: Complete manufacturer’s product literature and samples (if requested) for all pre-approved substitutions to the recommended products made during the course of the Project.
2. Permits: The Contractor shall obtain all required permits and provide copies to the Owner/Engineer
3. Product Literature: Complete manufacturer’s product literature for all electronics, cable, cable supports, cable labels, outlet devices, and other products to be used in the installation. In addition, whenever substitutions for recommended products are made, samples (when requested by the Owner/Engineer) and the manufacturer’s supporting documentation demonstrating compatibility with other related products shall be included.
4. Testing: Proposed Contractor test result forms, a list of instrumentation to be used for systems testing.

5. A complete point-to-point floor plan diagram indicating camera locations and all required cabling to connect systems.

D. Project Completion: As a condition for project acceptance, the Contractor shall submit the following for review and approval:
1. Inspection and Test Reports: During the course of the Project, the Contractor shall maintain an adequate inspection system to ensure that the materials supplied and the work performed, conform to contract requirements. The Contractor shall provide written documentation that indicates that materials acceptance testing was conducted as specified. The Contractor shall also provide documentation, which indicates that all cable termination testing was completed and that all irregularities were corrected prior to job completion.
2. Operating and Maintenance Manuals for all devices within the system. These instructions shall reflect any changes made during the course of construction, and shall be provided to the Owner, for their use, in a three-ring binder labeled with the project name and description.
3. All training sessions with district staff and training media shall be complete.
4. As-built Drawings shall include cable pathways, camera locations with correct labeling and MDF/IDF locations. The as-built drawings shall be prepared using AutoCad V. 2013 or later. Provide the Owner with electronic versions of the as-builts on CDs.

PART 2 – PRODUCTS

2.1 GENERAL

A. The Contractor is responsible for providing all incidental and/or miscellaneous hardware not explicitly specified below as required for a complete and operational system.

B. Materials shall be as listed or shall be approved equivalent products of other manufacturers meeting the intent and quality level of the specifications. All approved equivalent products shall be published by addendum ten days prior to proposal for Engineer review.

C. All equipment and materials used shall be standard components, regularly manufactured, regularly utilized in the manufacturer’s system.

D. All systems and components shall have been thoroughly tested and proven in actual use.

E. All systems and components shall be provided with the availability of a toll free 24-hour technical support phone number from the manufacturer. The phone number shall allow for immediate technical assistance for either the dealer/installer or the end user at no charge.

F. All systems and components shall be provided with an explicit manufacturer warranty.

2.2 DATA CLOSET (MDF/IDF) TERMINATION HARDWARE

A. Security contractor is responsible to coordinate with data/voice cabling contractor on acquiring network connections. Contractor shall coordinate with District technology department on acquiring any network configuration information such as IP numbers that will be required.

B. Structured Cabling Contractor is responsible to provide network cabling connection, either fiber or category 6, to Owner provided network equipment. This connection allows ~~NVR~~/Cameras to be connected to Owner’s local area network.

2.3 CABLE AND INSTALLATION

A. The data cabling to each camera location on this project shall be provided by Structured Cabling Contractor installing new infrastructure on site.

B. Provide all penetrations and all conduits as necessary for installation of CCTV installation.

C. All exterior penetrations require necessary weatherproofing to avoid moisture penetration.

D. All outdoor cable runs underground shall be rated for underground use.

E. Provide all power circuits required for the camera power supplies.

F. Contractor shall not run any power cabling for any security equipment on rack tray system due to EMI considerations. Contractor shall provide individual cabling support for all low voltage power cabling.

G. All cabling for entire project shall be installed at 5'-0" intervals in dedicated support system using supports such as j-hooks or saddle support systems. Cable supports shall be securely attached directly to building structure. Do not attach cabling or supports to ductwork, piping, grid hangers, conduit, or equipment.

2.4 CAMERAS

A. ACCEPTABLE MANUFACTURERS
1. Axis

B.

TYPE	MOUNTING TYPE	MANUFACTURER	MODEL
TYPE A	CORNER	AXIS	P3737-PLE
TYPE B	WALL	AXIS	P3737-PLE
TYPE E	CORNER	AXIS	P4707-PLVE
TYPE F	WALL	AXIS	P4707-PLVE
TYPE G	PARAPET	AXIS	Q3819-PVE
TYPE H	SOFFIT	AXIS	P4707-PLVE
TYPE J	CEILING	AXIS	F4105-LRE
TYPE K	WALL	AXIS	P3265-LV
TYPE L	CEILING	AXIS	P3265-LV
TYPE M	WALL	AXIS	M4327-P
TYPE N	POLE	AXIS	P3265-LVE
TYPE P	CEILING	AXIS	P3737-PLE
TYPE Q	CEILING	AXIS	P4707-PLVE

1. Provide mounts as needed:
Corner Bracket: T91A64
Wall Mount: T91D61
Parapet Mount: TQ6501-E
Pole Mount: T91B47

2. Provide Main unit as needed:
Axis F9114 4-Channel Main Unit with Audio and I/O

3. Contractor to provide latest model AXIS camera and accessories from series if part numbers are discontinued or obsolete at time of installation at no additional cost to owner.

C. Field of View Determination by the contractor as necessary for fixed camera locations shall be performed at no additional cost to provide the view desired by the owner. Contractor shall coordinate all final camera views and locations with owner for final approval.

D. Ceiling mounted cameras shall be installed with the weight of the camera being supported by the building structure. At no point should the weight of any camera be supported by the ceiling tile.

E. All cameras installed shall be focused at nighttime in black and white/low resolution mode to ensure the best possible view.

2.5 VIDEO SERVER AND EQUIPMENT

A. Licensing: Provide the Owner with all licenses as required for installation. Milestone xProtect Expert Camera Connection; (1) for each camera on drawings.

B. Contractor Shall Provide 3-years of Care Plus.

2.6 ARCHIVING

A. Coordinate programming of IP address of Owner provided wide area archiver.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Cable Support:
1. All wire not installed inside conduit or a designated cable tray system shall be installed in a dedicated cable j-hook style support system for the entire run of each cable. Including, but not limited to service loops.
2. The cable support system shall be attached directly to the building steel at a serviceable height. If the building steel is not 5’ of the finished ceiling, the contractor shall provide a dedicated threaded rod extending within 5’ of the finished ceiling and mount the support hook to the treaded rod.
3. Cable support shall be installed at a maximum of 5’ on center.
4. All cable installed shall be attached to the hook support system with plenum rated Velcro and a plenum rated Velcro tie shall be installed between each cable support to keep wires neatly bundled throughout the entire run. Tie wraps will only be allowed to be used inside the control panels as required to manage the wires within each type of panel.
5. Absolutely no cable, not installed in conduit, will be allowed to be attached directly to the building’s steel or supported in any other method than that stated above.
6. It is the responsibility of the installing contractor to coordinate with all other trades on the project to ensure that the pathway of this system does not interfere with the installation of the other trades and to prevent the installed product of other trades from putting strain on the installed wiring.
7. Do not route cable through webbing of structural steel.

B. Conduit / Raceway:
1. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit "fill" shall not exceed 40% per NEC.
2. Conduit and raceway system shall be installed as specified under the general electrical section of the specifications, and per NEC.
3. Minimum conduit size shall be 3/4" EMT. Install conduit per engineered shop drawings.
4. Systems utilizing open wiring techniques with low smoke plenum cable shall provide

conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed or subject to damage.

5. All conduit ends shall have a protective bushing to prevent cable damage. Bushings must be installed prior to installing cable. Cutting bushing to install around installed cables will not be accepted.

C. Fire Wall Penetrations: The Contractor shall avoid penetration of fire rated walls and floors wherever possible. Contractor shall also seal all floor, ceiling and wall penetrations in fire or smoke barriers and in the wiring closet.

D. Wall Penetrations: Where penetrations are necessary, they shall be sleeved with metallic conduit and resealed with an Underwriter Laboratories (UL) approved sealant.

E. Install new roof mounted conduits on portable pipe supports – (low profile type), as manufactured by Portable Pipe Hangers or Advanced Support Products. Provide roof protection pads under each support. Coordinate location and routing with design engineer prior to rough-in or installation of system.

F. Do not install wall mounted cameras into metal fascia. Ensure they are mounted into brick, and sealed top and sides (not bottom)

3.2 EQUIPMENT RACK CONFIGURATION

A. Cable Placement: Cable installation in the wiring closet must conform to the Project Drawings. All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance location. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser without difficulty at a later time by maintaining a working distance from these openings.

B. Cable shall be routed as closely as possible to the ceiling, floor or corners to ensure that adequate wall or backboard space is available for current and future equipment. All cable runs within the wiring closet shall be horizontal or vertical within the constraints of minimum cable bending radii. Minimum bend radius shall be observed. Cables shall not be tie-wrapped to electrical conduit or other equipment.

C. All incoming cables shall be routed on the cable tray and neatly dressed down to the patch panels.

3.3 WIRING INSTALLATION

A. General:
1. All network cabling shall be provided and installed by the network cabling contractor. Cabling between wiring closet and camera locations shall be made as individual home runs. No intermediate splices may be installed or utilized between the wiring closet and the camera location.
2. All cable must be handled with care during installation so as not to change performance specifications.
3. Coordinate jack color with structured cabling specification.

B. Placement: All cabling and associated hardware shall be placed so as to make efficient use of available space. All cabling and associated hardware shall be placed so as not to impair the Owner’s efficient use of their full capacity.

3.4 ADDITIONAL REQUIREMENTS

A. Confirm rack hardware mounting locations with Owner prior to installation.

B. Coordinate with network cabling contractor to ensure installation of cable service loops to all camera locations and future camera locations.

C. Provide final aiming, focus, and other camera configuration adjustments as directed by Owner.

D. Lens: Provide and install the following lens types for the exterior cameras, in addition to the lenses supplied with the camera:
1. 60^ 4.0mm
2. 38% 2.8mm
3. 2% 8mm

3.5 DOCUMENTATION

A. Labels: The Contractor shall label all outlets using permanent machine engraved labels approved by the Owner. Label patch panels in the wiring closet to match those on corresponding camera locations. The font shall be at least one-eighth inch (1/8”) in height, block. All labels shall correspond to as-built and to final test reports.

B. Contractor shall ensure complete typed labeling of all cameras with numbers that correspond to locations on video server. Labeling system shall correspond to the Owner’s labeling system. Verify with Owner. Provide tags (black letters on white labels, plastic coated) on all cables and outlets.

C. All cables shall be labeled at both ends with a machine label and all terminations shall be stenciled with a typed label for quick circuit identification. Labeling shall conform to TIA/EIA standard 606 and include interconnect cable identification numbers.

D. A floor plan, clearly labeled with all numbered camera locations, shall be included in the as-built plans.

3.6 CABLE TESTING - BY MANUFACTURER’S REQUIREMENTS

A. Notification: The Owner/Engineer/Consultant shall be notified one week prior to any testing so that the testing may be witnessed.

B. Final Acceptance: Before requesting a final acceptance, the Contractor shall perform a series of end-to-end installation performance tests. The Contractor shall submit for approval a proposal describing the test procedures, test result forms and time table for all copper and fiber optic cabling.

C. Procedures: Trained personnel shall perform all testing. Acceptance of the test procedures discussed below is predicated on the Contractor’s use of the recommended products and adherence to the inspection requirements and practices set forth. Acceptance of the completed installation shall be evaluated in the context of each of these factors.

D. Errors: When errors are found, the source of each error shall be determined, corrected and the cable retested. All defective components shall be replaced and retested. Retest results must be entered on the test results form. All corrections shall be made prior to final acceptance test.

3.7 INSPECTION

A. Conformance to the installation practices covered above is to be verified when completed. In

some cases, the Owner/Engineer may observe before acceptance.

3.8 WARRANTY

A. The product shall perform in all material respects in accordance with the accompanying user manual, and the media on which the Software Product resides will be free from defects in materials and workmanship under normal use. Software defects are covered through Service Releases and Cumulative Updates which are available for a period of 1 year from the date of the software purchase.

3.9 DEPLOYMENT SERVICES AND SYSTEM COMMISSIONING

A. General Requirements
1. The contractor shall engage the services of the Milestone vendor to assist in the management of the deployment of the Milestone at the end-user site on the project.
2. The Milestone vendor services shall include Deployment Management and System Configuration and Commissioning.
3. Provide 4 hours of system programming per site.

B. Deployment Management Service
1. The Deployment Management service from the vendor shall include a Project Manager acting as the single point of contact for all communications between the contractor and the vendor organization and who will be responsible for:
a. Conducting a Risk Assessment of the impact of potential risk factors on the operation of the vendor's Milestone.
b. Providing a project plan for the deployment of the vendor's Milestone.
c. Managing the development and deployment of the custom solution components that will be integrated into the vendor's Milestone (if applicable).
d. Providing a scope of work detailing the services to be provided by the vendor to assist in the deployment of the vendor’s Milestone.
e. Coordinating and scheduling the vendor field services with the contractor to assist with the deployment of the vendor’s Milestone.
f. Providing regular project status updates to the contractor regarding the development of custom solutions (if applicable) and the deployment of the vendor’s Milestone.

C. System Configuration and Commissioning Service
1. The System Configuration and Commissioning service from the vendor shall include a Field Engineer who will be responsible for:
a. Assisting the contractor’s or/subcontractor’s onsite/remote technicians with the configuration and commissioning of the vendor’s MILESTONE at the client site.
b. Conducting a test of the Milestone following the deployment of the system using real-world operator scenarios to ensure optimal system performance.
c. Providing the contractor with a Service Report detailing the tasks completed during the deployment of the Milestone at the client site, as well as any recommendations for improving the performance of the Milestone that must be implemented by the contractor.
d. Providing a knowledge transfer of the vendor's Milestone to the contractor following the deployment of the Milestone at the client site.

3.10 MANUFACTURER END USER OPERATOR TRAINING

A. The contractor shall engage the services of the Milestone vendor to assist in the end user training of the Milestone at the end-user site for 4 hours of training.

END OF SECTION 28 20 00

SECTION 28 46 00 FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
2. Supply, install and wire all field hardware, fire alarm control panel, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required.
3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.

B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of Specification Section 28 31 00. The Contractor shall provide all fire alarm and initiation devices required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

1.2 RELATED SECTIONS

A. Division 22 and Division 23

B. Sprinkler Systems

C. Food Service

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

A. National Fire Protection Association (NFPA):
1. NFPA 13 Systems, Installation
2. NFPA 17 Dry Chemical Extinguishing Systems
3. NFPA 70 National Electrical Code
4. NFPA 72 National Fire Alarm Code.
5. NFPA 80 Fire Doors and Fire Windows
6. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
7. NFPA 92A Smoke Control Systems
8. NFPA 101 Life Safety code.
9. NFPA 105 Smoke Control Door Assemblies
10. NFPA 2001 Fire Extinguishing Systems, Clean Agent

B. UL: Underwriters Laboratories, Inc.
1. 217 Single and Multiple Station Smoke Detectors.

2. 268 Smoke Detectors for Fire Protective Signaling Services.
3. 864 Control Units for Fire Protective Signaling Services, 9th Edition.
4 864 Transient protection
5. 1480 Speakers for Fire Protective Signaling Systems
6. UL Fire Protection Equipment Directory.
7. UL Electrical Construction Materials Directory.

C. Uniform Federal Accessibility Standards (UFAS).

D. Factory Mutual P7825 Approval Guide

E. American National Standards Institute (ANSI).

F. National Electrical Manufacturer's Association (NEMA).

G. Institute of Electrical and Electronic Engineers (IEEE).

H. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.

I. Requirements of American Disabilities Act (Public Law 101-336).

J. Local Accessibility Standards

K. State Fire Marshall or Requirements of Local Authorities having Jurisdiction

L. State Insurance Code

M. International Building Code Adopted by Local Authority Having Jurisdiction

N. Local & State Building Codes

O. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years.

B. Manufacturer's product shall have been in satisfactory operation on three installations of similar size, type and design as this project, for approximately 3 years.

C. Manufacturer shall submit at the time of bid a list of installations where the products have been in operation.

D. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.

E. The entire Fire Detection and Alarm System shall be installed by an authorized representative of the Fire Alarm Manufacturer and certified by the manufacturer to

distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.

F. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.

G. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.

H. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.

I. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.

J. The installing contractor shall have on his staff a Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State Insurance Code.

K. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems as required by the Texas Board of Professional Engineers.

L. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.

M. Material shall be new and in perfect condition when installed.

N. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.

1.5 COORDINATION

A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.

B. Contractor shall schedule a pre-construction meeting with Owner/Architect regarding the Fire Detection and Alarm System.

1.6 DEFINITIONS

A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
   1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
      a. The operation of a manual station.
      b. The operation of a fire suppression system switch.

2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require and immediate response, but do not require immediate notification of the Fire Department.
3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.
4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

1.7 SUBMITTALS

A. Contractor shall meet with Owner's Fire Alarm System representative prior to submission of formal/final shop drawings to Architect to allow the Owner and Architect to review a preliminary draft copy of the submittal to verify compliance with the specifications and any detailed requirements of the project. After the draft submittal has been reviewed by the Architect / Owner / Engineer, and formal shop drawings have been reviewed by Architect and returned to the Contractor, the required pre-construction meeting shall take place with Owner / Architect / Engineer.

B. Before the final set of shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the authorities having jurisdiction (AHJ).

C. Fire alarm submittal shall be bound and separate from all other submittals. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
1. Provide a complete written, item-by-item, line-by-line, specification review stating compliance or deviation in full description.
2. Complete point-to-point wiring diagrams.
3. Complete floor plan drawings locating all system devices.
4. Complete system bill of material of all hardware components.
5. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
6. Provide a complete description of system operation.
7. Manufacturer's installation instruction.
8. Bound form with contractor's name, supplier's name, project name, state fire alarm license, Fire Alarm Planning Superintendent license and all Technician(s) license adequately identified.
9. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
10. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
11. Field and factory wiring diagrams of all systems and for typical devices showing all connections with all terminals and interconnections identified.
12. Complete schematic circuit diagrams for all equipment, including panel modules.
13. Floor plan drawings including all panel and device locations, conduit sizes between devices and panels; number, size and type of conductors between devices and panels; walls, doors and graphic room numbers; exact power

requirements and conduit routing with the location of all junction boxes and exact locations of devices and equipment. Submit a floor plan drawing circuiting/zoning shall be identified on the drawings.

14. Complete wiring, routing, and schematic diagrams, software descriptions, and details required to demonstrate that the system has been coordinated and will function as a system.
15. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
16. Installation details for each type of field mounted device installed under this contract.
17. Point-to-point termination schedules with cable identification numbers and terminal strip numbers.
18. Fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
19. Submit a riser diagram of trunk wiring and device-to-device wiring and device to fire alarm control panel wiring. Riser shall show:
    a. Conduit sizes and types.
    b. Number, size and type of conductors.
    c. Fire detection and alarm devices arranged in the required circuiting/zoning, as defined in the specifications and on the drawing.
    d. Battery calculations to show compliance with the requirements of the specifications for both alarm and supervisory mode.
20. Submit sound and visual level to confirm that number and location of signaling devices will provide required sound and visual levels throughout the building.
21. Sample of proposed graphic/text annunciation.

1.8 OPERATION AND MAINTENANCE MANUALS

A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.

B. The Operation and Maintenance Manual shall consist of the following:
1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system operating modes.
3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the

system and other information necessary to enable proper system usage.

5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to “AS BUILT”.

1.9 AS-BUILT DRAWINGS

A. Prepare and submit detailed “As-Built” drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. These drawings shall be submitted to be inserted in the specified Operations and Maintenance Manuals.

1.10 OPERATIONAL INSTRUCTIONS

A. Provide a typeset printed or a laser jet printed instruction card mounted behind a lexan plastic or glass cover in a stainless steel or aluminum frame. Install the frame in a conspicuous location observable from the Fire Alarm Control Panel (FACP). The card shall show those steps to be taken by an operator when a signal is received as well as the functional operation of the system under all conditions, normal, alarm, and trouble. The instructions shall be approved by the Architect/Engineer before being posted.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers acceptable contingent upon Products’ compliance with the specifications:
   1. Notifier – Notifier Engineered Systems Distributor

2.2 SYSTEM DESCRIPTION

A. System shall be a completely multiplexed addressable fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where required or specified, shall have voice alarm notification wherever audible notification is required.

B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
   1. Alarm
   2. Trouble.
   3. Open
   4. Short
   5. Device missing/failed.

C. The systems shall include a Connected Life Safety Services (CLSS) Gateway for connections to the CLSS cloud, central station, mobile productivity tools or third party services.

D. System circuits shall be wired as follows: Initiating device circuit (IDCs) shall be Style B, indicating appliance circuit (IACs) shall be Style Y, and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.

E. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.

F. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.

G. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.

H. Auxiliary manual controls shall be supervised so that an “off normal” position of any switch shall cause an “off normal” system trouble.

I. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green “power on” LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.

J. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.

K. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate and the audible trouble signal shall sound.

L. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

M. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full charge in four hours.

N. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.

O. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.

P. A maximum of 75 percent capacity of addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices

within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.

Q. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.

R. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.

S. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style Y circuit. Plenum rated fire alarm cable shall have an outer jacket insulation color of red. Minimum wire size shall be #18 AWG.

T. Each panel extender shall have an individual address.

2.3 FIRE ALARM CONTROL PANEL (FACP)

A. The FACP shall be capable of communicating with the types of addressable devices specified below. It shall display only those primary controls and displays essential to operation during a fire alarm condition. Keyboards or keypads shall not be required to operate the system during fire alarm conditions. Panel shall support a minimum of 500 addressable points.

B. The fire alarm control panel (FACP) shall be fully enclosed in a lockable steel enclosure as specified herein. All operations required for testing or for normal care and maintenance of the system shall be performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, the unit enclosures shall match exactly. The system shall operate at 24 VDC.

C. Panel shall be large enough to accommodate all components and also to allow ample gutter space for interconnection of all panels as well as all field wiring. Each enclosure and each component shall be identified by an engraved red laminated phenolic resin nameplate. Lettering on the nameplate shall not be less than 1" high. Individual components and modules within the cabinets shall be identified by engraved laminated phenolic resin nameplates.

D. A local audible device shall sound during alarm, trouble, or supervisory conditions. This audible device shall sound differently during each condition to distinguish one condition from another without having to view the panel. This audible device shall also sound during each key press to provide an audible feedback to ensure that the key has been pressed properly.

E. The following primary controls shall be visible through a front access panel:
1. Minimum 80-character alphanumeric display.
2. Individual red system alarm LED.
3. Individual yellow supervisory service LED.
4. Individual yellow trouble LED.
5. Green “power on” LED.
6. Alarm acknowledge key.

7. Trouble acknowledge key.
8. Alarm silence key.
9. System reset key.

F. Under normal condition, the front panel shall display a “SYSTEM IS NORMAL” message and the current time and date.

G. Should an abnormal condition be detected, the appropriate LED (Alarm, Supervisory or Trouble) shall flash. The panel audible signal shall pulse for alarm conditions and sound steady for trouble and supervisory conditions.

H. The 80-character display shall provide the following information relative to the abnormal condition of a point in the system.
1. 40-character custom location label.
2. Type of device (i.e. smoke, pull station, water flow).
3. Point status (i.e. alarm, trouble).
4. Addressed device physical location to correspond to the actual graphic room numbers. Where devices are located in hallways, corridors, or large spaces, the location shall include the hallway, corridor, or large space and in addition reference to the nearest room or other physical object recognizable by the Owner. Example (smoke detector, alarm, Corr 123 by Rm 789), exact format and abbreviations as directed by Owner to fit the panel display format.

I. Alarm conditions shall be displayed on the 80-character display. The top line of 40 characters shall be the point label and the second line shall be the device type identifier. The system alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged, this same LED shall latch on. A subsequent alarm received from another zone shall flash the system alarm LED on the control panel. The 80-character display shall show the new alarm information.

J. Each independently supervised circuit shall include a discrete readout to indicate disarrangement conditions per circuit.

K. Acknowledgment for each abnormal condition shall be provided. Acknowledge keys shall not be pass code protected. Acknowledge keys shall be protected by the locked enclosure only. After all points have been acknowledged, the LEDs shall glow steady and the audible device be silenced. The total number of alarms, supervisory and trouble conditions shall be displayed, along with a prompt to review each list chronologically. The end of the list shall be indicated by the message, “END of LIST”.

L. Pressing the appropriate acknowledge button shall display the first unacknowledged condition in the appropriate list (either alarm, supervisory or trouble), and shall require another acknowledge button for each subsequent alarm condition. Press to acknowledge shall only silence the displayed point.

M. Alarm silencing:
1. Should the “Alarm Silence” button be pressed, all audible alarm signals shall cease operation.
2. Visual signals shall not be extinguished during alarm silence inhibit mode.

N. System reset:
1. The “System Reset” button shall be used to return the system to its normal state after an alarm condition has been remedied. The 80-character display or reset LED shall step the user through the reset process with simple English Language messages.
2. Should an alarm condition continue to exist, the system shall remain in an

abnormal state. System control relays shall not reset. The audible device and the alarm LED shall be on.

3. Should the alarm silence inhibit function be active, the System Reset and alarm silence key shall be ignored.

O. Additional function keys, or their equivalent, shall be provided to access status data and control the function for the following points:
1. HVAC - Bypass
2. Indicating appliance circuits bypass
3. Auxiliary relays points bypass
4. All other input/output points.

P. The following status data or their equivalent shall be available:
1. Primary state of point.
2. Device, PID and card type information.
3. Current priority of outputs.
4. Disable/enable status.
5. Verification tallies of initiating devices.
6. Automatic/manual control status of output points.
7. Acknowledge status.
8. Relay status.

Q. LED supervision: Where provided, all slave module LEDs shall be supervised for burnout or disarrangement. Should a problem occur the 80-character display shall display the module and LED location numbers to facilitate location of that LED.

R. System trouble reminder: should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at pre-programmed time intervals to act as a reminder that the fire alarm system is not 100% operational. Both the time interval and the trouble reminder signal shall be programmable.

S. The fire alarm control panel features shall include, but not be limited to:
1. Setting of time and date.
2. LED testing.
3. Alarm, trouble, and abnormal condition listing.
4. Enabling and disabling of each monitor point separately.
5. Activation and deactivation of each control point separately.
6. Changing operator access levels.
7. Walk test enable.
8. Running diagnostic function.
9. Displaying software revision level.
10. Displaying historical logs.
11. Displaying card status.
12. Point listing.
13. For maintenance purposes, the following lists, or their equivalent, shall be available from the system program and/or the point lists menu:
    a. All points list by address.
    b. Monitor point list.
    c. Signal list.
    d. Auxiliary control list.
    e. Feedback point list.
    f. LED/switch status list.
14. Fire Drill:
    a. Fire drill activation switch shall activate all audio/visual devices only. Fire drill shall not enter into the alarm sequence of operation, shall not close

smoke or fire/smoke dampers, shall not deactivate any HVAC systems, kitchen hoods, etc.

b. Activation of any trouble or alarm condition shall supercede the evacuation drill.

c. Fire drill shall be canceled by the system reset key, alarm silence, or drill key.

15. Scrolling through menu options or lists shall be accomplished in a self-directing manner. These controls shall be located behind an access door.

16. The 80-character display shall have an alpha numeric, back-lighted LCD, LED, or gas plasma display. The display shall support numeric and both upper and lower case letters. Lower case letters shall be used for soft key titles and prompting the user. Upper case letters shall be used for system status information. A cursor shall be visible when entering information.

17. The system shall be capable of being tested by one person. The actuation of the “enable walk test” program at the fire alarm control panel shall activate the “Walk Test” mode of the system, which shall cause the following to occur:

a. The remote monitoring circuit connection shall be bypassed.

b. Control relay functions shall be bypassed.

c. The control panels shall show a trouble condition.

d. The panel shall be capable of selecting either: the alarm activation of any initiation device causing the audible signals to activate for two seconds or the alarm activation of any initiation devices causing the audible signals to code a number of pulses to match the zone number.

e. The panel shall automatically reset itself after signaling is complete.

f. Any momentary opening of an initiating or indicating appliance circuit wiring shall cause the audible signals to sound for 4 seconds indicating a trouble condition.

g. The control panel shall be capable of supporting up to 8 separate testing groups whereby one group of points may be in a testing mode and the other (non-testing) groups may be active and operate as programmed per normal system operation. After testing is considered complete, testing data may be retrieved from the system in chronological order to ensure device/circuit activation.

h. Should the walk test feature be on for an inappropriate amount of time, it shall revert to the normal mode automatically.

18. Provide three (3) access levels with level 3 being the highest level. Level 1 action shall not require a pass code. Pass codes shall consist of up to ten (10) digits. Changes to pass codes shall only be made by Level 3 authorized personnel.

a. When entering a pass code, the digits entered shall not be displayed. All key presses shall be acknowledged by a local audible sound and/or visual “*” in the 80 character display.

b. When a correct pass code is entered, the new access level shall be in effect until the operator manually logs out or the keypad has been inactive for ten (10) minutes.

c. Should an invalid code be input, access shall be denied.

d. Access to a level shall only allow the operator to perform all actions within that level plus all actions of lower levels, not higher levels.

e. The following keys/switches, or their equivalent shall have access levels associated with them:
Set time/date.
Manual control
Disable/enable
Clear historical alarm log
Clear historical trouble log
Walk test

Change alarm verification

f. The following keys/switches shall not be pass code protected and shall be protected by the lockable enclosure:
Alarm Silence
System Reset
Acknowledge

19. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of being reprogrammed to accommodate system expansion and facilities changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control panel. Loss of primary and secondary power shall not erase the instructions stored in memory.
20. Resident software shall allow for full configuration of initiating circuits so that additional hardware shall not be necessary to accommodate changes in, for instance, sensing of normally open contact devices to sensing of normally closed contact devices, or from sensing of normally open contact devices to sensing a combination of current limited and non-current limited devices on the same circuit and being able to differentiate between the two, or changing from a non-verification circuit to a verification circuit or vice-versa.
21. Resident software shall also allow for configuration of indicating appliance and control circuits so that additional hardware shall not be necessary to accommodate change in, for instance changing a non-coded indicating appliance circuit to a coded circuit.
22. The main fire alarm panel shall have the resident ability to store a minimum of 600 system events in chronological order of occurrence. Event history shall include all system alarms, troubles, operator actions, unverified alarms, circuit/point alterations, and component failures. Events shall be time and date stamped. Events shall be stored in non-volatile buffer memory. Access to history buffer shall be secured via 5-digit password security code. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. Loss of primary or secondary power shall not erase the events stored in the memory. Each recorded event shall include the time and date of that event's occurrence.
    a. The following Historical Alarm log events shall be stored:
    Alarms
    Alarm acknowledgment
    Alarm silence
    System reset
    Alarm historical log cleared
    b. The following historical trouble log events shall be stored:
    Trouble conditions
    Supervisory alarms
    Trouble acknowledgment
    Supervisory acknowledgment
    Alarm verification tallies
    Walk tests results
    Trouble historical log cleared
23. Alarm verification shall be by device, whereby only verification from the same device will confirm the first activation and cause the alarm sequence to occur.
24. The control panel shall have the capability to display the number of times (tally) a device has gone into a verification mode. Should this verification tally reach a pre-programmed number, a trouble condition shall occur.
25. The control panel shall have a dedicated supervisory service LED and a dedicated supervisory service acknowledge key. Pressing the supervisory service acknowledge key shall silence the supervisory audible signal while

maintaining the supervisory service LED “ON” indicating the off-normal condition.

26. Activation of an auxiliary bypass key shall override the selected automatic functions.
27. The system shall have keys that will allow the operator to display all alarms, troubles, and supervisory service conditions including the time of each occurrence.
28. RS-232-C output: the fire alarm control panel shall be capable of operating remote IBM compatible PC and/or printers; output shall be ASCII from an EIA RS-232-C connection with an adjustable baud rate. Each RS-232-C port shall be capable of supporting and supervising a remote CRT and printer. Data amplifiers shall be used to increase data line distance when required. The fire alarm control panel shall support three (3) RS-232-C ports and shall be expandable for additional RS-232-C ports.
29. Panel shall be sized to accommodate all required equipment. Panel shall be equipped with locks and transparent door, providing freedom from tampering yet allowing full view of the various displays and controls.

T. The fire alarm control panel shall have a 25% spare module and battery capacity for future use. Space module(s) shall be provided in panel with terminals labeled. Each initiating circuit shall have 25% spare capacity. Space modules shall be provided in the fire alarm control panel with terminals labeled.

U. The power supply shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER-LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of five (5) 110cd visual devices in the future. Individual design loading shall not exceed 70% of power supply and system wiring capacity.

1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
2. Surge protection shall be integral to the control panels.
3. Each power supply shall be monitored and have an individual address.

V. Digital Fire Alarm Communicator - Connected Life Safety Services (CLSS) Gateway

1. Provide Gateway for FACP monitoring
2. Connect and configure built-in IP port to campus network
3. Connect and configure built-in Cellular Communications Module for either ATT or Verizon
    a. Coordinate with owner for chosen service provider

W. Detector sensitivity shall be programmable from the control panel from the following sensitivities: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 and 3.7% obstruction. Detectors shall be able to be programmed to alert a trouble signal at a lower obstruction and shall report an alarm if the smoke density increases to a predetermined set point. Control Panel and Detectors shall be capable of “Day-Night” automatic sensitivity adjustments.

X. Control Switches:

1. Acknowledge/step Switch
2. Signal Silence Switch

3. System Reset Switch
4. System Test Switch
5. Lamp Test

Y. Automatic Detector Test: The system shall include a special automatic detector test feature, which permits reading and adjustment of the sensitivity of all intelligent detectors from the main control panel. An automatic detector test shall occur automatically fourteen times each twenty-four hour period or be initiated manually from the FACP as desired. In addition, the automatic test feature shall also permit the functional testing of any "intelligent" detector or addressable interface device individually from the main control panel. Automatic detector test sequencing shall be terminated upon receipt of an alarm condition. Detector test shall report all unprogrammed devices installed and report all programmed devices not installed.

Z. Emergency voice alarm communication system:

1. The emergency voice and tone communication system shall be a pre-built system and shall only require two wires from a polarity reversal circuit or a dry contact for activation. It shall supervise the NO dry contact (if used) and provide a form C trouble relay activation in the event of a system fault. The Voice Communication System shall incorporate minimum 50 watts true RMS amplifiers for both tone and speech amplification. The system shall have a load capacity of up to 100 watts. Optionally, the Voice Communication System shall be capable of providing 50 watts of audio with full backup. The Voice Communication System shall be capable of operating as a stand-alone system or follow the activation of the fire alarm/suppression system. The Voice Communication System shall include a regulated power supply and shall be capable of charging and housing its own batteries. There shall be no need to calculate the load requirements or draw any energy from the fire alarm/suppression system. The Voice Communication System shall come with one speaker supervisory zone as a standard and shall be capable of supervising any combination of up to 11 speaker and/or strobe monitoring modules.
2. A full set of control switches including an all call, tone interrupt, trouble silence and reset shall be available at the Voice Communications System. The Voice Communications System control panel shall also have a green POWER ON LED, a red ALARM LED, a yellow BROWN OUT LED and a yellow SYSTEM TROUBLE LED.
3. The Voice Communication System shall be able to detect a short on any speaker or strobe zone during the normal and alarm mode. The shorted zone shall be isolated from the system and a dedicated LED on the supervised zone shall indicate the short circuit condition. The system shall produce an audible and visual signal indicating that a trouble condition has occurred. Similarly an open circuit shall create a trouble condition and corresponding LED annunciation at the affected zone and at the main control module. Zones that are not shorted or opened shall remain operational.
4. The Voice Communications System shall be able to detect a brownout condition on the AC supply. In the brownout condition the Voice Communication System shall activate a dedicated LED and an audible trouble signal. Ground faults shall activate the system trouble LED and the audible trouble signal, as well as specific LEDs indicating negative and positive ground faults.
5. The Voice Communication System shall be field configurable for 25 or 70.7 volt RMS audio output via program jumpers.
6. The Voice Communication System shall have a digital message player / recorder. The digital message player / recorder shall be capable of storing alert and evacuation tones as well as an emergency voice message. It shall be possible to modify the digital message and tones in the field using a built-in

acoustic microphone or headphone jack connected to an audio device. There shall be no need for the burning of eproms in order to program the digital message player / recorder. The digital message player / recorder shall be supervised by the Voice Communication System. The Voice Communications System shall provide a backup evacuation tone in the event of a digital message player / recorder failure.

7. An alarm condition shall cause an audible signal and a red LED to activate. A Voice Communication System with a digital message player / recorder shall produce an ALERT tone followed by an emergency voice message, and in turn followed by an ALARM tone. The number of tone repetitions shall be configurable by the setting of DIP switches on the digital message player / recorder.
8. The sheet metal enclosure shall include a hinged deadfront allowing easy access to all the Voice Communication System components for the purposes of wiring, setting the system configuration and servicing. A door with a key lock shall be part of the Voice Communication System enclosure.

2.4 FIELD DEVICES

A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.

B. Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
2. All visual devices mounted in student toilets / restrooms, and student locker / dressing rooms shall have a protective cover. All wall mounted visual devices installed in gymnasiums, corridors, kitchen preparation and serving areas, vocational shops, athletic/drill team training rooms, and where wall mounted in cafeterias, corridors and commons areas, shall have a protective cover; STI Stopper #STI1221E Series. Provide enviro kit for locations where dampness, water or dust is present.

C. Combination Alarm Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.
2. All combination audio / visual devices mounted in student toilets / restrooms, and student locker / dressing rooms shall have a protective cover. All wall mounted combination audio/visual units installed in gymnasiums, corridors, kitchens, preparation and serving area, vocational shops, athletic/drill team training rooms, and where wall mounted in cafeterias, corridors and commons areas, shall have a protective cover; STI Stopper #STI1220E Series. Provide enviro kit for locations where dampness, water or dust is present.
3. The audible emergency alarms shall produce a sound that exceeds the prevailing

sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder with or without protective cover. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.

D. Exterior Audible / Visual Signal:
1. Provide semi-flush mounted, molded of high impact red thermoplastic and listed for exterior weatherproof locations.

E. Combination Voice Signal and High Intensity Visual Signals:
1. Strobe lights shall be of the electronic flashing xenon strobe type and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
2. All combination units installed in student toilets, gymnasiums, corridors, student locker / dressing rooms, kitchens, vocational shops, athletic / drill team training rooms, cafeterias, commons areas, shall have a protective cover, STI Stopper #STI1220E Series. Provide enviro kit for locations where dampness, water or dust is present.
3. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a xenon strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
4. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.

F. Ceiling mounted recessed mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle or 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles Capacitor for line supervision.

G. Surface mounted speakers shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision. Raco #911 Series Life Safety Appliance back box and adapter, or appliance manufacturer back box.

H. Manual Pull Station: Addressable pull stations shall contain electronics that communicate the station's status (alarm, normal) to the control panel over two wires which also provide power to the pull station. They shall be manufactured from high impact red Lexan with white lettering. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations shall be double action without glass rods. The front of the station shall be hinged to a back plate assembly and shall be opened with a key to reset the station. The key shall be common with the control panels. The addressable manual station shall have address setting programmed electronically and automatically from the fire alarm control panel. Manual stations shall be designed for semi-flush (surface) mounting on standard electrical box. All pull stations units shall have a protective cover, STI Stopper II #STI-1130 surface

mounted cover with local alarm horn. Provide STI, Weather Stopper II #STI3150 for locations where dampness, water or dust is present.

I. Intelligent Photoelectric Smoke Detectors:
1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
2. The detectors shall provide address-setting means electronically and automatically at the control panel.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base. No radioactive material shall be used.
5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.

J. Duct photoelectric smoke detectors:
1. Detectors shall be analog addressable type.
2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm point. No radioactive material shall be used.
3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
5. Remote alarm/power LED indicator shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.
8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
9. The detectors shall provide address setting means electronically and automatically from the control panel.

K. Intelligent Thermal Detectors:

1. The detectors shall use dual electronic thermostats to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
2. The detectors shall provide address-setting means electronically and automatically at the control panel.
3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist-lock base.
5. Thermal Detectors shall be combination rate-of-rise and fixed-temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as specified and where required by local code authority.
6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.

L. Addressable Carbon Monoxide Detection:
1. System sensor #CO1224 with addressable identification of the CO Detector's alarm and trouble contact status. UL listed to Standard 2075 Standard for Gas and Vapor Detectors and Sensors.
2. Unit to be powered by the fire alarm system non-resettable 24 VDC supervised power supply.
3. Electro-chemical CO detection.
4. Integral 85db local alarm with local hush/test switch for silence or test.
5. Alarm contacts and trouble contacts for detector trouble, loss of power, and end of life.

M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.

N. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices.
2. The monitor module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and indicate detection of an alarm condition.

O. Control Module
1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module may be optionally wired as dry contact (form C) relay.
2. The control module shall provide address-setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.

P. Auxiliary Interface Points: All auxiliary input points (fire suppression hoods, water flow, fire pump, AHU shut-down points, tamper switches, fire extinguishing systems etc.) shall be connected as required, and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.

Q. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.

2.5 VESDA – VERY EARLY WARNING ASPIRATING SMOKE DETECTION SYSTEM

A. Approved Manufacturers:
1. System Sensor (FASAST) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.
2. Xtralis (VESDA) – Detection devices for Cooler / Freezer areas 200 square feet or larger, atriums / high ceiling areas with difficult access.

B. A Very Early Warning Smoke Detection System similar to the VESDA VLI System shall be installed throughout the cooler and freezer storage areas 200 square feet and larger, and as an alternative to beam type detectors at high ceiling areas with difficult access.. The system shall consist of highly sensitive LASER-based Smoke Detectors with aspirators connected to networks of sampling pipes, intelligent filtration arrangement with fail-safe operation, sub-sampling probe (inertial separator), built-in clean air zero capability, local USB configuration port and Ethernet networking port. VESDA detection system shall be networked with the specified Notifier Fire Alarm Control Panel.

C. Design Requirements
1. The system shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modeling tool.
2. It shall be tested and approved to cover up to 2,000m^2 (20,000 sq.ft).
3. It shall have a built-in simple user interface indicating alarm and fault status and include a reset / disable button.
4. It shall provide absolute smoke detection.
5. It shall be approved to provide very early warning smoke detection and provide four alarm levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.05-20% obs/m (0.016–6.4% obs/ft.).
6. The detector shall be specifically designed for industrial applications.
7. It shall consist of a highly sensitive LASER-based smoke detector with in-field clean air zero capability, aspirator, intelligent filter and secondary filter.
8. It shall be modular, with field replaceable detection chamber, aspirator, intelligent filter and secondary filter.
9. It shall have four pipe inlets for sample air.
10. It shall incorporate per pipe ultrasonic flow monitoring and provide staged airflow faults.
11. It shall have a built-in and field replaceable intelligent filter placed after the flow monitoring circuitry.
12. Intelligent filter shall:

a. Dilute the sampled air for prolonged detector life.
b. Combine sample air from all pipe inlets.
c. Divide sampled air into filtered clean air and unfiltered air before mixing them together.
d. Use HEPA filter with more than 99% efficiency for filtered clean air i.e. removing more than 99% of contaminant particles of 0.1microns or larger, to provide clean air for dilution.
e. Use a mesh/screen for the unfiltered air for protection against lint type of particles.
f. Be fail-safe and supervised for correct operation with built-in capability to alert for when replacement is required.
g. Maintain consistent detector sensitivity over time.
h. Have ultrasonic airflow monitoring of the unfiltered sampled air through the intelligent filter.

13. It shall have a field replaceable aspirator after the intelligent filter where the diluted sampled air flows through the aspirator prolonging its life.
14. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 360m (1,200ft) in total, (4 pipe runs per detector) with a transport time per applicable local codes.
15. It shall have a sub-sampling probe (inertial separator) after the aspirator for reduced dust intake in to the detection chamber.
16. It shall have a secondary foam filter after the sub-sampling probe (inertial separator) where the sub-sampled air flows through the foam filter prolonging detection chamber life. The foam filter shall be capable of filtering particles in excess of 20 microns from the sampled air.
17. It shall have a field replaceable smoke detection chamber which stores the calibration values with the chamber assembly.
18. It shall have capability for in-field clean air zero to provide absolute smoke detection.
19. It shall have capability to measure blockages in the air path in to or out of the detection chamber.
20. It shall have an enclosure rating of IP54.
21. The detector shall allow for direct wall mounting or using a supplied mounting plate.
22. It may be inverted as required in specific applications.
23. It shall be self-monitoring for filter contamination.
24. It shall be configured via local USB port with Ethernet port for remote monitoring.
25. It shall have Fire and Fault relay outputs in addition to three configurable relays. The relays shall be software programmable to the required functions and must be rated at 2 AMP at 30 VDC.
26. It shall have at least one general purpose input (GPI).
27. It shall have Power In and Power Out connections to allow powering more than one detector from one power supply.
28. Optional equipment may include a dedicated Xtralis VSM graphics package.
29. It shall report any fault on the unit by using configurable fault relay outputs or via PC based configuration and monitoring system.
30. The detector shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events.

D. Programming Requirements

Using either USB or Ethernet port the detector shall allow programming of:

1. IP address and related fields to support Ethernet based networking

2. Four smoke threshold alarm levels
3. Time delays
4. Configurable relay outputs for remote indication of detector conditions
5. Holidays and day/night changeover times
6. Major and minor airflow fault limits
7. Aspirator speed
8. General purpose input function
9. Alarm and fault latching

E. Sampling Pipe
1. The sampling pipe shall be smooth bore. Normally, pipe with an outside diameter (OD) of 25mm or 1.05” and internal diameter (ID) of 21mm or ¾” should be used.
2. The pipe material should be suitable for the environment in which it is installed. VESDA pipe material shall be UL 1887 Plenum rated CPVC).
3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
4. The pipe shall be identified as Air Sampling/Aspirating Smoke Detector Pipe along its entire length at regular intervals not exceeding the manufacturer’s recommendation or that of local codes and standards.
5. All pipes shall be supported at not less than 1.5m (5ft) centres, or that of the local codes or standards.
6. The far end of each trunk or branch pipe shall be fitted with an end-cap and made air-tight by using solvent cement. Use of an end-cap will be dependent on ASPIRE2 calculations.

F. Sampling Holes
1. Sampling holes shall not be separated by more than allowed for conventional point detectors as required by 30 feet as local codes and standards. Intervals may vary according to calculations. For NFPA the maximum allowable distance is 30ft.
2. Each sampling point port shall be identified in accordance with Codes or Standards.
3. Provide per manufacturer’s recommendations and standards in relation to the number of sampling points and the distance of the sampling points from the ceiling or roof structure and forced ventilation systems.
4. Sample port size shall be as specified by ASPIRE2 calculations.

G. Detection Alarm Levels:
The laser based ASD system shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:
Alarm Level 1 (Alert)
Activate a visual and audible alarm in the fire risk area.
Alarm Level 2 (Action)
Activate the electrical/electronic equipment shutdown relay and activate visual and audible alarms in the Security Office or other appropriate location.
Alarm Level 3 (Fire 1)
Activate an alarm condition in the Fire Alarm Control Panel to call the Fire Monitoring Service and activate all warning systems.
Alarm Level 4 (Fire 2)
Activate a suppression system and/or other suitable countermeasures.
The alarm level functions as listed are possible scenarios. Program as directed by Owner to the best utilization of these facilities for each application and the requirements of local A.H.J.

H. Initial Detection Alarm Settings

1. Alarm Level 1 (Alert) 0.2% obs/m (0.064% obs/ft.)
2. Alarm Level 2 (Action) 0.3% obs/m (0.096% obs/ft.)
3. Alarm Level 3 (Fire 1) 0.40% obs/m (0.128% obs/ft.)
4. Alarm Level 4 (Fire 2) 2.0% obs/m (0.64% obs/ft.)

I. Initial (factory default) Alarm Delay Thresholds
Initial (factory default) settings for the alarm delay threshold shall be:
1. Alarm Level 1 (Alert) 10 seconds
2. Alarm Level 2 (Action) 10 seconds
3. Alarm Level 3 (Fire 1) 10 seconds
4. Alarm Level 4 (Fire 2) 10 seconds

J. Fault Alarms: The Detector Fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel (FACP) in such a way that a Detector Fault would register a fault condition on the FACP. The Minor Fault and Isolate relays shall also be connected to the appropriate control system. Provide as required by local Codes, Standards or Regulations.

K. Power Supply and Batteries: The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery backup is required followed by 30 minutes in an alarm condition.
1. UL 1481 Listed -provided the power supply and standby batteries have been appropriately sized / rated to accommodate the system's power requirements.
2. Provide 120-volt 20-amp circuit from the life safety branch panel to each power supply.

2.6 AUXILIARY EQUIPMENT MONITORING

A. The fire alarm system shall monitor the status of the following equipment when provided as part of this project. A failed status shall activate the trouble alarm.
1. Emergency generator: Run Status
2. Emergency generator: Trouble Signal
3. Fire Pump: Run Status
4. Fire Pump: Trouble Signal

2.7 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.

B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
2. Permit the automatic roll down fire doors/shutters to close automatically.
3. Permit the security grilles with emergency egress to open automatically.
4. Unlock the electrically controlled access doors in all interior spaces.

C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire

door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.

D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.8 REMOTE ALPHA-NUMERIC DISPLAY ANNUNCIATORS

A. Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an 80-character display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:
1. Integral time-date clock
2. System reset
3. System silence
4. System acknowledge
5. Display/step switch
6. Integral trouble buzzer
7. LCD contrast adjust
8. Fire Drill Operation

B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
1. 80 character alphanumeric display, LCD, LED, or gas plasma
2. Individual red system alarm LED
3. Individual yellow supervisory service LED
4. Individual yellow trouble LED
5. Green “POWER ON” LED
6. Alarm acknowledge key
7. Trouble acknowledge key
8. Alarm silence key
9. System reset key
10. LED test

2.9 REMOTE PAGING UNIT

A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

2.10 PRINTER AND PRINTER STAND

A. A high impact dot matrix printer shall be provided. The printer shall provide hard-copy printout of all changes in status of the system and shall time-stamp such printouts with the current time-of day and date. The printer shall be wide carriage with 80-characters per line and shall use standard pin-feed paper. The printer shall communicate with the control panel using as interface complying with EIA standard RS-232. Printer shall be capable of operating on parallel or serial outputs. Power to the printer shall be 120VAC at 60Hz. The printer shall print all status information including status, address, event history and programmed custom ID message.
1. High speed, bi-directional.

2. Serial or parallel interface.
3. Front panel interface.
4. Supports modems for remote installation.
5. LED status indicators.
6. RS-232 direct cable supervised.
7. Printer self test mode.
8. 9-Pin, impact, dot matrix printer with minimum speed of 232 characters per second.

B. Printer Stand:
1. Steel and laminate construction
2. Two shelves for paper storage
3. 28H x 26W x 20 Inches deep
4. Locking casters

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.

B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.

C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.

D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.

E. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.

F. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.

G. Provide two dedicated phone lines from telephone company demarcation point to fire alarm panel. Telephone cable shall be Category 6 rated and installed in 3/4" conduit.

H. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a

vault, stub required conduit inside vault, turn up and cap.

I. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.

J. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area and additional annunciators where indicated on the drawings.

K. Provide remote paging units adjacent to each remote alphanumeric display annunciator for voice alarm systems.

L. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.

M. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.

N. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.

O. Power for magnetic door holders shall be wired through fire alarm relay.

P. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.

Q. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for the main fire alarm control panel, each panel extender and each remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel. Label 120V circuit origination (i.e.: “120-Volt Circuit ELA-3”)

R. Provide smoke detectors in the following locations:
1. All paths of egress and adjoining spaces within the same envelope including but not limited to: corridors, hallways, stairs, lobbies, and elevator landings.
2. At each electrical room, telecommunications/data room, elevator machine room, kiln room, and mechanical room not subject to un-treated or un-filtered outside air.
3. At each computer lab/room.
4. At each library, library office and library ancillary areas.
5. At each storage room, stock room, or warehouse space.
6. At each pre-K and kindergarten classrooms.
7. At nurse’s area/clinic and patient care/cot areas.
8. At each men’s and women’s restroom/toilet
9. At each administrative work room or copy room.
10. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.

S. Provide heat/thermal detectors in the following locations:
1. At each electrical room, telecommunications/data room, elevator machine room and mechanical room subject to un-treated or un-filtered outside air.
2. At each janitor’s/custodial closets.

3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.
4. At each employee break room/lounge.
5. At each vocational shop.
6. At each science, physics, chemistry, or biology classroom and their associated preparation and storage rooms.
7. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas with food preparation or cooking equipment.

T. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.

U. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.

V. Provide duct smoke detectors on outside air units only as required by local Code and / or A.H.J.

W. Provide VESDA type detectors at the following locations when appropriate:
1. Atriums.
2. High ceiling corridors where maintenance of spot type detectors may be difficult.
3. Areas with skylights.

X. Provide manual pull stations at each exterior exit and at each exit from all floors. Provide one manual pull station at the central reception area as directed by Owner.

Y. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
1. Main entry.
2. Courtyards and outdoor assembly areas adjacent to the building.
3. Mechanical yards adjacent to the building.
4. Covered playgrounds or covered assembly areas adjacent to the building.
5. Additional locations where indicated on drawings.
6. Outdoor paved play areas.

Z. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.

3.2 CABLE AND BOXES INSTALLATION

A. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.

B. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.

C. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.

D. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.

E. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.

F. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.

G. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40%.

H. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings. All conduit terminations in all boxes shall have insulated bushings.

I. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.

J. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.

K. All junction boxes containing fire alarm wiring are to be painted red and labeled.

L. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with cable ties on a maximum of 2'-6". Install cable in D-ring hangers, secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork, or foreign equipment.

M. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.

N. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.

O. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.

P. No other wiring shall be run in the same conduit as fire alarm wiring.

Q. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations.

3.3 FINISHES

A. Main Fire Alarm Panel color shall be approved by Owner / Architect.

3.4 ALARM SYSTEM SEQUENCE OF OPERATION

A. General:
1. All fire alarm circuits shall be electrically supervised.
2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.

B. Fire alarm operating sequences shall be as follows:
1. Activation of any automatic detector, manual station, or sprinkler flow switch shall cause the location of alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
b. The 80-character display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location, and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by Owner). Point ID and descriptor must be sent and received.
e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
f. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
g. De-activate all HVAC systems.
h. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
i. Close all related smoke dampers.
j. Close all related smoke/fire dampers.
k. Release all magnetic door hold open devices.
l. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
m. Release Counter Shutters and hold-open devices on all fire and smoke doors.
n. Open all security grilles with emergency egress.
o. Activate to close all related fire and smoke doors and shutters.
p. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
q. Signal the building automation system and security system, and Owner’s

security/police personnel as directed by Owner/Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged and appropriate action has been taken.

r. Activate automatic recall operation of elevators as required by local authority having jurisdiction.

s. Record all events on the system printer.

2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall send an alarm signal to the control panel and also initiate the Alarm Sequence of Operation.

3. Activation of a control valve supervisory switch shall initiate the following events:
   a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
   b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.
   c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence the audible signal.

4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.

5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.

6. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.

C. Activation of the manual evacuation (drill) switch shall operate the alarm indicating appliances without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.

D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

3.5 EQUIPMENT IDENTIFICATION

A. Each panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:
   1. Name of manufacturer.
   2. Manufacturer's equipment description.
   3. Serial number and model number.
   4. Voltage and current rating.

3.6 SPARE PARTS AND TOOLS

A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.

B. Spare Parts: Provide minimum of two, or 5% of building total, whichever is greater unless noted otherwise.
1. Spare shut down modules
2. Spare detectors of each type in the system
3. Spare alarm indicating devices of each type in the system
4. Spare manual pull stations
5. Spare protective covers of each type in the system.
6. Spare relays/controls required for connection to smoke and fire/smoke dampers
7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.

C. Provide two copies of the final software programmed into the fire alarm system.

D. One box of printer paper.

E. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

3.7 KEYS

A. Keys and locks for all equipment shall be identical. Provide not less than six keys of each type required. Identify keys by an appropriate number stamped on each key or on a metal tag attached thereto. Provide a key numbering chart in each operation and maintenance manual furnished.

3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.

B. Coordinate motor operator voltage with supplier.

C. Open all dampers prior to starting air handling equipment.

D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

3.9 GRAPHIC FLOOR PLANS

A. Provide two (2) color coded floor plan detailed with project name, actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers.

B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the

annunciator. Indicate location of all end-of-line resistors.

C. The floor plan shall be solvent welded in acrylic plastic.
   1. Mount in an extruded aluminum frame next to the main fire alarm control panel and annunciator in main office.

   Minimum size 11x17 inches.

D. Install graphic floor plans as directed by Architect/Owner prior to substantial completion. Each area or room designation shall be verified with the fire alarm device during testing.

3.10 OPERATING INSTRUCTIONS

A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.

B. Provide Fire Alarm System Operating Instructions for the following items including, but not limited to:
   1. Alarm Signal
      a. How to open panel door
      b. What to read and follow the instruction on display
      c. How to acknowledge alarm
      d. How to silence the signals
      e. How and when to reset the system
      f. How to return system to normal operation
   2. Trouble / Supervisory
      a. How to open panel door.
      b. What to read and follow the instruction on display
      c. How to acknowledge trouble condition
      d. Appropriate personnel to respond

C. Provide laminated instructions in extruded aluminum frame. Mount adjacent to the Fire Alarm Control Panel and remote annunciator panel(s) for ready reference.

3.11 ADDITIONAL REQUIREMENTS

A. The contractor is to ensure all areas of the building are covered with visual and audio alarm devices for occupant notification of a fire alarm, including remote portable or temporary buildings.

B. Coordinate door hold devices with door and door hardware.

C. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems and elevator equipment.

D. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (5) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability.

E. Install system event printer as directed by Owner/Architect.

F. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

G. Provide one dedicated alarm circuit for (future) portable (temporary) building(s) to the nearest main building egress exit discharge to the designated portable building location. Provide 100 feet of cable coiled and marked “FACP-ALARM-PORTABLES” above an accessible ceiling.

H. Provide one dedicated addressable initiating device circuit with a minimum capacity of 50 devices for (future) portable (temporary) building(s) to the nearest man building egress discharge to the designated portable building location. Provide 100 feet of cable coiled and marked “FACP-INITIATING PORTABLES” above an accessible ceiling.

I. Provide printer and printer stand at main FACP; exact location as directed by Owner / Architect.

3.12 COMMISSIONING THE SYSTEM

A. The installing contractor shall be responsible for verifying that each component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.

B. A state licensed and factory trained technical representative of the manufacturer shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.

C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Field testing shall include voice intelligibility as required by the latest edition of NFPA 72 Any items found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded and an electronic and printed copy submitted to the Architect, Engineer and Owner.

D. The installing contractor shall provide a complete written report in electronic form and printout of the functional test and intelligibility test of the entire system. A copy of the test report shall be provided with the Maintenance and Operation Manuals. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be witnessed and accepted by the Owner prior to testing for the local Fire Marshall.

E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.

F. The testing and acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:
1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
3. A functional fault simulation test shall be conducted on all relevant field wiring

terminations to ensure that wiring is properly supervised as required.

4. Indicators shall be tested to ensure proper function and operation.
5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
8. Manual initiating devices:
   a. Each manual fire alarm station shall be functionally tested for alarm operation.
   b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
9. Automatic initiating devices:
   a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
   b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
   c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
10. Alarm signaling devices:
    a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area's voice alarm signaling devices shall be tested for intelligibility.
    b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
    c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
    d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
11. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.

G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance is to be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.

H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.

3.13 SUBSTANTIAL COMPLETION

A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.

B. All fire alarm system shop drawings, test reports, operating and maintenance manuals, maps and as-built drawings shall be submitted in electronic format to and accepted by the Architect / Owner prior to date of substantial completion.

C. Acceptance by County or Local Fire Marshall.

3.14 WARRANTY

A. The fire alarm system, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Major components including but not limited to the main fire alarm panel, sub-panels, panel extenders, power supplies and emote annunciators. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification. Any equipment replaced shall be complete with full factory warranty for that part beginning on the date of installation.

B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.

C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.

D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.

E. Provide a certified fire alarm test of the complete system no earlier than 30 days prior to the end of the warranty period and correct any and all items to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts at no cost to the Owner.

F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of “As-Built” drawings and schematics of all equipment.

G. All manufacturer’s warranties which extend past final completion shall be fully transferred to the Owner.

3.15 TRAINING

A. Provide training course to all fire personnel assigned by Owner’s Representative. The training shall include a course syllabus and hands-on participation. Training shall be conducted on a system identical to the one being installed on this project. The system shall be able to perform all system operations and simulate all types or forms of alarm conditions.

B. Provide a video of the training program to the Owner’s Representative to be used for periodic refresher course, training of the local fire department and for training of new employees.

C. The training course shall include, in addition to the above, a system overview, and a

review of the operation and maintenance manual.

D. The instructor shall be factory trained and shall be thoroughly familiar with all parts of the installation on which instruction is to be given. The instructor shall be trained in operating theory as well as in practical operation and maintenance work.

END OF SECTION 28 46 00

SECTION 28 55 00 RF SURVEY FOR IN-BUILDING EMERGENCY RESPONDER RADIO COVERAGE (ERRC) AND TESTING OF EXISTING ERRC ENHANCEMENT SYSTEMS (EERCES)

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The purpose of this specification is to establish the requirements and standards for surveys for public safety radio signal strength in buildings as required by the NFPA, IBC, IFC and local AHJ. This specification is only for a RF survey. If an existing ERRCES is on premise and is operational, provide verification and documentation of the existing ERRCES as specified.
   1. This survey is required as part of the contract documents and shall be implemented as specified in this specification unless indicated or specified otherwise.
   2. This survey is required for in all buildings with basements, all buildings four stories and taller, and all buildings with an aggregate total building area of 50,000 square feet or more; this survey may still be required for other buildings that do not meet these structural requirements.
   3. This survey may not be required if the local AHJ has pre-determined that an Emergency Responder Radio Coverage Enhancement System (ERRCES) is not required for the subject building(s). If a survey is not required by the AHJ, notify the Architect, Engineer, Owner prior to scheduling the survey.
   4. The survey requirements specified in this section are intended to be slightly more stringent than minimum IBC and IFC requirements. This is to help mitigate radio coverage deficiencies that could be caused by future minor variations in building use configurations and changing atmospheric conditions.

B. Where the subject building(s) do not have an existing ERRCES, this survey shall be for ERRC measurements and compliance evaluation only, it is not intended as a requirement for designing nor a requirement for providing an ERRCES.

C. Where the subject building(s) have an existing and operational ERRCES, this survey shall include a full yearly functionality test of the existing ERRCES hardware, antennae, wave guides, cabling, wiring, and connectivity as required by the local AHJ, IBC, IFC, and NFPA. This survey shall then be able to be used for the required yearly inspection and testing report of the existing ERRCES. If deficiencies of an existing ERRCES are observed or detected during field signal measurement, the contractor shall document those deficiencies and report them to the Owner in writing within two Owner's business days of completion of the testing so that the Owner can take immediate remedial action. Corrections and modifications to existing ERRCES are not part of this specification section requirements.

D. Technical information for this survey shall be obtained from the local AHJs pertaining the specific technical information and requirements for the emergency responder communications coverage system. This information shall include but not be limited to the various frequencies required, the location of radio antennae sites, the effective radiated power of the AHJ radio antennae sites, the maximum propagation delay in microseconds, the applications being used, and other supporting technical information that would be necessary for an ERRCES design and to fully test an existing ERRCES.

E. Surveys for new construction shall be performed after the building is fully dried in, with interior wall construction and all exterior wall glazing completed, and prior to start of

installation of electrical wiring. It is the intent that this survey be completed as soon as practical, results reported to the Owner and analyzed, and if required or specified as part of the contract documents or if it is to be provided by others, a radio antenna/repeater system can be designed, installed, fully operational, and commissioned without delaying the scheduled contract date for certificate of occupancy (CO) or the AHJs final inspection and approval for full Owner and public occupation of the building.

F. Conduct surveys using a RF Spectrum Analyzer, a calibrated system-compatible radio or another suitable instrument with traceable certificate of calibration to analyze the RF signal strength of Emergency Responder Radio Signal into the building and determine if amplification of the signal is required or that if existing, the existing ERRCES is functioning properly and providing the proper radio coverage. All test equipment shall have been calibrated within the previous 12-months of the date(s) of testing. Both inbound and outbound signal strength shall be determined, measured, calculated, and documented as required by code. General weather conditions and time of day during the test shall be documented as part of the survey report.

1.2 SURVEY CRITERIA

A. The required Public Safety Radio Signal Level inside the Owner's facility shall be as required by code, ordinance, AHJ, and as specified.

B. Survey shall be performed by an FCC licensed technician holding a current General Radiotelephone Operator License (GROL). Where required by the local AHJ, the licensed operator shall be registered with the AHJ as an ERRC Special Inspector (or equivalent designation given by the AHJ) with in-building emergency radio system certification issued by a nationally recognized organization, school, or the emergency radio system manufacturer of the equipment being tested where an existing ERRCES is being tested, or certification by the ERRCES if a new ERRCES is specified elsewhere to be installed as part of the contract documents.

1.3 REGULATIONS

A. Codes, regulations, and standards shall be the latest published standards. The latest national published standards listed below shall supersede any local standard unless doing so would violate the intent of the local code requirements.
1. NFPA 1 – Fire Code
2. NFPA 70 – National Electrical Code
3. IFC 510- Emergency Responder Radio Coverage
4. NFPA 101, Life Safety Code, and all local amendments and requirements.
5. NFPA 72 National Fire Alarm and Signaling Code
6. FCC 47 CFR Telecommunications
7. FCC 47 CFR 90.219 Use of Signal Boosters
8. IFC - International Fire Code
9. Local or State Fire Codes
10. ADA "Americans with Disabilities Act" and any local or state or local accessibility standards and amendments.
11. FCC's OET 65 Standards "Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields"
12. FCC Rules Part 22 Public Mobile Services, Part 90 and Part 101
13. NFPA 1221- Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
14. IBC - International Building Code

15. UL 2524 - Standard for In-building 2-Way Emergency Radio Communication Enhancement Systems
16. NFPA 3000 (PS) - Standard for an Active Shooter/Hostile Event Response (ASHER) Program and if present, Owner's specific ASHER Program. Note: Although currently considered by the NFPA as a Provisional Standard (PS), the issued NFPA 3000 shall be considered part of this specifications as if it were a fully accredited document to NFPA standards. If the building Owner has established an ASHER Program, it too shall be considered part of this specification section requirements.

1.4 DEFINITIONS

A. Definitions:
1. Area: A enclosed space in a building consisting floor to ceiling walls with doors.
2. ASHER Program: Active Shooter Hostile Event Response Program. Program elements developed by the building's Owner to determine the necessary functions and actions related to preparedness, response, and recovery from an active shooter/hostile event response.
3. BDA: Bi-Directional Amplifier. A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station and in the downlink from the base station to subscriber devices for enhanced signals and improved coverage.
4. BER: Bit Error Rate is the number of bit errors per unit time
5. DAS: Distributed Antenna System
6. ERRCES / ERRCS: Emergency Responder Radio Coverage Enhancement System / Emergency Responder Radio Coverage System. A two-way radio communication system installed to assure the effective operation of radio communications systems for fire, emergency medical services, or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
7. FCC: Federal Communications Commission
8. Grid or test grid: The individual specified and/or code required imaginary spaces inside the building used for radio coverage testing. Typically a grid space consist of a square space with equal or almost equal side dimensions where the radio signal levels are measured at the center of each grid space to verify radio coverage. Grid spaces can consist of individual areas or rooms meeting the maximum size requirements.
9. GROL- FCC General Radiotelephone Operators License
10. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
11. Public Safety/First Responder: Public Safety or First Responder agencies that are charged with the responsibility of responding to emergency situations. These include, but are not limited to law enforcement departments, fire departments, and emergency medical companies. Typically, there may be multiple agencies for each type of responder, including those administered by the building Owner.
12. RSSI: Received signal strength indicator RSSI is a relative measurement of the power present in a received radio signal.
13. Zone: The individual partitioned grid specified and/or code required imaginary space(s) inside large buildings. Typically, each zone shall be no more than 50,000 square feet and shall be contiguous on the same building floor. Zones are further sub-divided into smaller grid spaces so that radio signal levels can be measured at the center of each grid space to verify radio coverage. A zone can be an individual wing of a building or separate floors of a building that do not exceed 50,000 square feet each. Zones can be created for separate test report areas to ensure individual grid test spaces are not excessive in physical area

size and detrimental to the accuracy and resolution of the test data measurement point locations. Each zone must pass the radio coverage test for the entire building to pass the test. Zones can exceed 50,000 square feet as long as the maximum allowable grid space size is not exceeded.

PART 3 – EXECUTION

3.1 EXECUTION

A. Testing Procedures and Parameters

1. The test shall be conducted using a calibrated portable radio authorized by the local AHJ, and of the latest brand and model used by the agency talking through the agency's radio communication system.
2. Testing shall include all critical areas required by the NFPA 1221 and others included in the list below. Critical areas shall be provided with a minimum 99-percent floor area radio coverage in each specific area. Critical areas include but are not limited to the following areas:
   a. Fire command centers
   b. Fire pump rooms
   c. Exit stairs
   d. Exit passageways
   e. Elevator lobbies
   f. Areas of rescue or refuge
   g. Areas with or spaces adjacent to standpipe cabinets
   h. Areas with or spaces adjacent to sprinkler sectional valve locations
   i. Areas with or spaces adjacent to bleeding control kits.
   j. Areas with or spaces adjacent to Automatic External Defibrillators (AEDs) for public use.
   k. Areas designated for persons with special needs or areas for specifically designated for persons who are not ambulatory including those in wheelchairs but require physical assistance by others to evacuate the building.
   l. Specific bullet resistant areas or spaces designated by the Owner or designated in the Owner's ASHER Program as a bullet resistant panic and safe room/areas or spaces.
   m. Front lobby areas and/or building administrative areas with direct wired microphone or wired telephone handset access to the building's mass notification or building wide communication system when such system is existing or to be installed as part of this project.
   n. Areas and/or building administrative areas with public safety radio base stations used for direct communications with Owner's police or security personnel.
   o. Other areas deemed critical by the AHJ.
3. Testing grid spaces, areas, and zones shall be as required by the local AHJ and/or as specified in this specification. The more stringent requirements of the local code, AHJ, or those specified or indicated elsewhere in the contract documents shall apply. Specific requirement for the test grids, areas, and zones shall be follows:
   a. Testing shall be based on a minimum of 20 approximately equal size grid spaces per floor or zone with a maximum of 2,500 square foot per test space. Failure of more than one test space shall be considered a test failure.
   b. In the event that only two test spaces fail the 20-space grid test above, the same floor/zone shall be divided into 40 approximately equal size

grid spaces or a maximum of 1,250 square feet per space and re-tested. Failure of only one or only two nonadjacent test spaces on that floor or zone shall result in a non-failure for that floor or zone. Failure of three or more spaces shall result in a test failure for that floor or zone. Failure of two adjacent test spaces shall result in a test failure of that floor or zone.

4. If there is an existing ERRCES and there are grid space test failures resulting in a failed test, notify the Owner in writing immediately about the failed spaces after the completed test and identify the specific areas of the building that are not compliant. The final test result formal submittal data may be submitted at a later date as specified. Contractor may provide recommendations for alterations or modifications to the existing system to the Owner/Architect/Engineer so that the deficiencies can be addressed by the Owner as soon as possible and corrective measures taken by the Owner. Make corrective measures or modifications to the existing system only if specifically instructed by the Owner in writing.
5. Two-way radio communications shall be verified by testing the two-way communication to and from the outside of the building from a single point approximately at the center of each test grid space or room area. Retesting from a different point inside the same grid space or room area is prohibited if the first point selected fails the test. The initial failure shall be recorded as a failed test grid space or area.
6. Signal strength for a non-failure shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as required by the AHJ.
7. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The inbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
8.. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as required by the AHJ. The outbound signal level shall be sufficient to provide not less than -95 dBm for analog systems or a Delivered Audio Quality (DAQ) of 3.0 for digital systems or an equivalent Signal-to-Interference-Plus-Noise-Ratio (SINR) applicable to the technology of either analog or digital signals.
9. Buildings with existing ERRCES: Verify the following, include the requested information report deficiencies to the Owner as part of the ERRC report.
   a. Verify the existing ERRCES is fully monitored by the building fire alarm system as required by NFPA 1221 and NFPA 72.
   b. If there is an existing remote ERRCES annunciator, verify all annunciators and indicators required by NFPA 1221 are operational and functioning properly.
   c. The gain values of all existing ERRCES amplifiers shall be measured and documented for comparison for future annual testing of the ERRCES.
   d. A spectrum analyzer or other suitable test equipment shall be used to verify spurious oscillations are not being generated by existing signal booster(s).
   e. Verify that the isolation between the donor antenna and all inside antennas is maintained to a minimum of 20dB above system gain.

3.2 SURVEY REPORT SUBMITTALS

A. Submit summary findings and detailed test report data within 14-days of notice to proceed.

B. Buildings not in compliance with the ERRC testing: Indicate areas of the building deficient in ERRC. Provide general recommendations of the necessary equipment and means required to bring the building into full ERRC compliance for Owner review in the summary findings. This specification section is only intended for survey, report, and recommendation information only and is not intended for detailed design, modification, or corrective measures. The report data submittal shall be complete in such that it would be useful to assist in a detailed design of a ERRCES. Submit additional report data as indicated below.

C. Building in compliance with required ERRC: Include a copy of the inspection report to be issued to the AHJ(s) in the format required by the AHJ(s) and submit the report to the AHJ(s) as part of the building permitting process.

D. Report data submittals shall include but are not be limited the following:
   1. Include a copy of survey contractor's AHJ and FCC required licenses to perform the survey.
   2. Where there is an existing ERRCES, include an updated ERRCES technical document and yearly report which the Owner shall keep on file as required by NFPA 1221. Technical documents shall in include but may not be limited to the following information typically provided by the AHJ(s):
      a. Frequencies required by the AHJ(s) for the existing in-building enhancement system (EERCES).
      b. Location and effective radiated power (ERP) of radio sites used by the public safety radio enhancement system (ERRCES).
      c. Maximum propagation delay in microseconds.
      d. List of specifically approved ERRCES components.
      e. Other supporting technical information necessary for the existing system maintenance, or future modifications.
   3. Confirmation that the ERRC for the building that is subject of the report has been determined to meet the minimum coverage requirement as defined by the IBC/IFC, this survey specification section's requirements, and the local AHJ requirements.
   4. Include a scaled drawing of the building with RF measurements of each floor or zone of the building which indicates relative RF field strength for each frequency band of interest. Minimum drawing size 11x17-inch, maximum 30x42-inch.
   5. The drawings shall indicate clearly the areas that have passed or failed based on the more restrictive of the above parameters or those specifically required by the AHJ.
   6. When required by the AHJ, inspection reports by AHJ approved third-party inspector in the format required by the AHJ.

END OF SECTION 28 55 00

SECTION 31 00 00 **SITE EARTHWORK**

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required and perform all excavation, backfill, fill and grading required to complete the work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; excavation and backfill for electrical manholes, handholes, conduits, cables, raceways and ducts; embankment and grading; disposal of waste and surplus materials; and all related work such as sheeting, bracing, and dewatering.

B. All excavation, trenching and related sheeting, bracing, etc, shall conform to the requirements of OSHA's excavation safety standards, 29 CFR 1926.650 Subpart P.

C. Excavation, backfill, and compaction for structures and piping are included in other sections as listed below.

1.2 RELATED WORK

A. Grading Excavation and Fill is included in Section 31 23 00.

B. Trenching and Backfill for Utilities is included in Section 33 05 28.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM C33 - Specification for Concrete Aggregates.

2. ASTM DI557- Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,00 ft-lbf/ft (2,700kN-m/m)

3. ASTM D1682- Standard Test Methods for Breaking Load and Elongation of Textile Fabrics.

4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes.

5. ASTM D4751- Standard Test Method for Determining the Apparent Opening Size of a Geotextile.

B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 PROTECTION

A. Sheeting and Bracing

1. Furnish, put in place and maintain such sheeting and bracing as may be required: by Federal, State and local safety requirements; to support the sides of excavations; to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction; and to protect adjacent structures from undermining or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill.

2. In order to protect adjacent structures, installation or removal of sheeting by vibratory or hammering methods shall not be allowed.

3. Construct the sheeting outside the neat lines of the foundation, unless indicated otherwise, to the extent deemed desirable for the method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressures to which the structure or trench will be subjected. Any movement or bulging which may occur shall be corrected to provide the necessary clearances and dimensions.

4. Where sheeting and bracing is required to support the sides of excavations for structures, engage a professional Engineer, registered in the State of Texas to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design and certification of this shall be provided by the professional Engineer. Submit P.E. Certification Form contained in Section 01 to show compliance with this requirement.

5. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed.

6. The right of the ENGINEER to order sheeting and bracing left in place shall not be construed as creating any obligation on his/her part to issue such orders and his/her failure to exercise his/her right to do so shall not relieve the CONTRACTOR from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the CONTRACTOR to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

7. No sheeting is to be withdrawn if driven below mid-diameter of any pipe and under no circumstances shall any sheeting be cut off at a level lower than 1-ft above the top of any pipe.

B. Pumping and Drainage

1. At all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be

floated or otherwise damaged by allowing water levels to return to natural levels. Engage a Geotechnical Engineer registered in the State of Texas to design the dewatering system in accordance with OWNER prior to commencing work.

2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.

3. Take all additional precautions to prevent uplift of any structure during construction.

4. Remove the dewatering equipment after the system is no longer required.

1.5 SOIL TESTING

A. Previous to the general placement of the fill and during such placement, the ENGINEER may select areas within the limits of the fill for testing the degree of compaction obtained. Cooperate fully in obtaining the information desired.

B. Payment for testing will be made by the CONTRACTOR as part of the project. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the ENGINEER, will be borne by the CONTRACTOR.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Select Common Soil and Structural Fill shall be as specified in Section 312300.

B. Common soil shall be as specified in Section 312300.

C. Crushed Stone

1. Crushed stone shall conform to Texas Department of Transportation Class 57 stone gradation.

D. Screened Gravel

1. Screened gravel shall be used for pipe bedding as detailed and at other locations indicated on the Drawings.

2. Screened gravel shall consist of hard, durable, rounded or subangular particles of proper size and gradation and shall be free from sand, loam, clay, excess fines and deleterious materials. The gravel shall be graded within the following limits:

Sieve Size	Percent Finer by Weight
5/8-in	100
1/2-in	40 to 100
3/8-in	15 to 45
No.10	0 to 5

PART 3 – EXECUTION

3.1 BACKFILLING - COMMON FILL

A. Common Fill may be used as trench backfill and fill against exterior walls of structures as indicated on the Drawings; as embankment fill; or in other areas as designated by the ENGINEER. Material conforming to the requirements of common fill shall be placed in layers having a maximum thickness of 2-ft measured before compaction.

B. Common Fill shall be compacted to at least 95 percent of maximum density as determined by ASTM D1557, Method D.

C. Materials placed in fill areas shall be deposited to the lines and grades shown on the Drawings making due allowance for settlement of the material and for the placing of loam thereon.

D. The surfaces of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan and no soft spots or uncompacted areas will be allowed in the work.

E. No compacting shall be done when the material is too wet either from rain or from excess application of water. At such times, work shall be suspended until the previously placed and new materials have dried sufficiently to permit proper compaction.

3.2 DISPOSAL OF SURPLUS MATERIAL

A. No excavated materials shall be removed from the site of the work or disposed of, except as specified by the ENGINEER. Materials shall be neatly piled so as to inconvenience as little as possible the public and adjoining property OWNERS until used or otherwise disposed of as specified below.

B. Suitable excavated material shall be used for fill embankments or backfill on the different parts of the work as required.

C. Surplus fill shall become the property of the CONTRACTOR and shall be removed and disposed offsite.

3.3 DISPOSAL AND REPLACING OF ROCK

A. Remove and dispose of all pieces of ledge and boulders which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil areas is to be replaced by approved surplus excavation obtained elsewhere on the work, insofar as it is available. Any deficiency in the backfill material shall be made up with acceptable material approved by the ENGINEER.

B. Fragments of ledge and boulders smaller than 50 lb weight may be used in backfilling trenches unless in the opinion of the ENGINEER the quantity is excessive, in which case he/she may order the removal and disposal of some of this rock. The small pieces of rock used as backfill shall not be placed in trenches until the pipe has at least 2-ft of earth over it. Place these pieces of stone in thin layers alternating them with earth to be sure that all voids between the stones are completely filled with earth to prevent the occurrence of voids and settlement which will result therefrom.

C. Rock may be used in embankment fill only with the approval of the ENGINEER.

3.4 GRADING

A. Grading in preparation for placing of loam, planting areas, paved walks and drives and appurtenances shall be performed at all places that are indicated on the Drawings, to the lines, grades and elevations shown and otherwise as directed by the ENGINEER and shall be performed in such a manner that the requirements for formation of embankments can be followed. All material encountered, of whatever nature, within the limits indicated, shall be removed and disposed of as directed. During the process of grading, the subgrade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of grading it is not possible to place any material in its final location, it shall be stockpiled in approved areas for later use. No extra payment will be made for the stockpiling or double handling of excavated material.

C. The right is reserved to make minor adjustments or revisions in lines or grades if found necessary as the work progresses, in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 4-in in their greatest dimensions will not be permitted in the top 6-in of the finished subgrade of all fills.

END OF SECTION 31 00 00

SECTION 31 11 00 CLEARING AND GRUBBING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for site clearing which may consist of:

1. Protection of trees indicated to be preserved.

2. Protection of above-ground and below-ground existing improvements indicated to be preserved.

3. Clearing, grubbing, removal and disposal of trees, stumps, brush, roots, vegetation, logs and rubbish.

4. Removal and disposal of above-ground and below-ground materials and existing improvements, including building demolition if any, as indicated.

5. Stripping and stockpiling of topsoil.

6. Stripping and stockpiling natural leaf mulch.

1.2 SUBMITTALS (NOT USED)

1.3 JOB CONDITIONS

A. Conduct demolition operations and removal of debris in accordance with governing regulations and Section 024117 - Demolition of these Specifications.

B. Ensure minimum interference with adjacent occupied or used facilities.

C. Exercise care to protect adjacent building, structures, and persons.

D. Above-ground and below-ground existing improvements, indicated to remain, shall be protected from damage prior to and during construction operations.

E. Tree Protection

1. Trees to be preserved shall be protected by barricades to avoid any confusion and damage prior to site clearing operations.

2. Contractor shall install barricades 3 ft. beyond drip line of trees to be protected. Construction equipment or storage activities shall not be permitted within the fenced area.

F. Protection of Existing Utilities and Adjacent Work

1. Prior to earthwork operations, existing utilities, facilities and permanent objects to remain shall be located and adequately protected. When working near public and private utility company lines, Contractor shall contact the local utility coordinating committee, or the utility company involved to locate their lines.

2. If unknown and uncharted utilities are encountered during excavation, promptly notify Owner and the governing utility company when determinable and wait for instructions.

3. If it is determined by Owner that such utility line has been abandoned, properly cap line at a depth approved by Owner or remove line as directed.

4. If such unknown utilities are encountered and work is continued without contacting the Owner for instructions, and the encountered utilities are damaged by continuation of the work, Contractor shall repair, at this own expense, such damage to the satisfaction of the Owner and the Utility Company. The Contractor shall be responsible for all costs to repair the damage.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEARING

A. Trees to be removed, stumps, brush, roots and vegetation shall be removed to a depth of not less than 2 feet below original or finish ground level, whichever is lower.

B. Miscellaneous vegetation, logs and rubbish shall be removed in their entirety, within the limits of improvements.

C. Topsoil shall be stripped to underlying subsoil. Topsoil shall be defined as friable organic clay loam surface soil, reasonably free of clay lumps, stones, weeds, roots and other objectionable material. Topsoil shall be safely stockpiled on the Site. Stockpiles shall be constructed to freely drain surface water.

D. Depressions caused by clearing, grubbing and stripping operations shall be filled with approved backfill material, unless further excavation is required by the construction operations. Backfill shall be placed in accordance with Section 312300 – Excavation, Grading, and Fill of these Specifications.

3.2 REMOVAL OF IMPROVEMENTS

A. Above-ground and below-ground existing improvements shall be removed in their entirety,except for utilities which shall be removed only to the extent indicated. Where utilities are indicated to be removed in part, the ends of the remaining utilities shall be permanently plugged with Class 3000 concrete.

3.3 DISPOSAL OF MATERIALS

A. Materials not scheduled to be salvaged shall become the property of the Contractor and shall be removed from the Site and legally disposed of. Burning or burying cleared, grubbed and demolition waste materials on the Site shall not be permitted.

B. Remove items, without damaging, scheduled to be salvaged as directed by the engineer and placed in designated storage area.

END OF SECTION 31 11 00

SECTION 31 23 00 GRADING, EXCAVATION AND FILL

PART 1 – GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. Protection of Trees

B. Field Engineering for Site Layout.

C. Testing Laboratory Services.

D. Fill Material for Pavement Subbase.

E. Concrete Reinforcing.

F. Cast-In-Place Concrete.

G. Informational Reference to Site Survey and To Subsurface Conditions.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. ASTM D 698, Test for Moisture-Density Relations of Soils (Standard Proctor).

2. ASTM D 2922, Test for Density of Soil in Place by Nuclear Method.

3. ASTM D 2487, Classification of Soils for Engineering Purposes.

1.3 SUBMITTALS

A. SAMPLES:

1. Submit 10-pound sample quantity of fill materials.

2. Submit 20-pound sample quantity of topsoil material.

3. Pack tightly in containers to prevent contamination.

1.4 GRADES

A. Carefully compare new grade requirements with existing conditions.

B. Provide necessary earth, grading and shaping work.

C. Extra payment will not be authorized for overage or shortage of material.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Sub base material: unwashed pit run or crushed gravel, crushed stone, or crushed slag, naturally or artificially graded with maximum aggregate size of 1-1/2 inches, as acceptable to testing laboratory.

B. Backfill and fill material: soil materials free of debris, waste, frozen matter, vegetable and other deleterious matter, as acceptable to testing laboratory.

C. Select fill: imported lean clay with a narrow plasticity index (pi) range of 10 to 15.

D. Lime treated structural fill: on-site clay mixture, free of silt, loam, friable or soluble materials and organic matter; treated in 6-inch lifts with 36 pounds per square yard of hydrated lime.

E. Backfill:

1. Free from rocks larger than 3 inches in size, alkali, salt, petroleum products, debris, waste, roots, vegetable, and other deleterious matter.

2. Excess non-vegetated excavated soils available from site may be used if conforming to specified requirements.

F. Lime: material conforming to SDHPT item 264, "hydrated lime and lime slurry".

G. Soil filter fabric: Irafi "1405" is specified; Dupont "Typar" is acceptable or approved equal.

PART 3 – EXECUTION

3.1 OBSTRUCTIONS

A. Remove obstructions within lines of improvements.

B. Refer obstructions of questionable nature to engineer.

C. Remove abandoned foundations down to 12 inches below finished grade, or the finished elevation of pavements and walks unless indicated otherwise on the drawings.

D. Remove foundations of light standards completely.

3.2 STRIPPING

A. Strip entire area to receive pavement and slabs on grade to a minimum depth of six inches to remove soil containing vegetated material.

B. Remove vegetated material from site as waste.

C. Remove topsoil; spread on areas already graded and prepared for topsoil, or deposit in storage piles convenient to areas subsequently to receive topsoil. Scarify existing asphalt surfacing and flexible base course material and remove from site.

D. Remove existing site improvements in areas scheduled to receive lawns, buildings, and

pavements.

E. Stripped material becomes property of contractor; remove from project site immediately and dispose of properly.

F. Maintain site surface drainage during construction.

3.3 EXCAVATION FOR UTILITY TRENCHES

A. Excavate using ladder-type trenching machine or backhoe unless indicated otherwise.

B. Cut trench sides vertical from trench bottom to one foot above top of pipe; slope back on stable slope above that point.

C. Extend trench width minimum 6 inches and maximum 18 inches each side of pipe.

D. Excavate trench to a minimum depth of 4 inches below bottom elevation of proposed pipelines.

E. Leave no more than 500 feet of trench open at one time.

F. Where augured hole is indicated, provide opening no larger than one inch greater than outside diameter of pipe bell.

3.4 DEWATERING

A. Keep excavations dry; maintain dewatered condition for depth of one foot below excavation bottom.

B. Operate suitable pumps necessary to keep excavations continuously free of water.

C. Discharge drainage waterlines into approved sewers only with appropriate approvals; use of sanitary sewer is prohibited.

D. Direct surface drainage away from excavated areas.

E. Control grading adjacent to excavations to prevent water running into excavated areas.

3.5 PERIMETER BACKFILL

A. Backfill exterior side of perimeter of structure with lime-treated on-site clay materials, carrying such fill up to indicated sub grades.

B. Backfill systematically and as early as possible to allow maximum time for natural settlement and compaction.

C. Commence backfilling after underground work has been inspected, tested, forms removed, and excavation cleaned of trash and debris.

D. Place and compact backfill to minimize settlement and avoid damage to work in place.

E. Place backfill simultaneously on both sides of freestanding structures; prevent wedging action against structure.

F. Place materials in successive horizontal layers of not more than 8 inches (4 inches for hand-held tamping equipment) and uniformly compacted to 92% of maximum density as confirmed by testing laboratory.

3.6 UTILITY TRENCH BACKFILL

A. Pipe bedding and backfill requirements for sanitary sewers shall be as specified in Section 333100, Sanitary Sewage Systems.

B. Pipe bedding and backfill requirements for storm sewers shall be as specified in Section 334100, Storm Sewage Systems.

C. Pipe bedding and backfill for water distribution system piping shall be in accordance with City of Port Arthur "Specifications for Water Main Construction and Materials" and "Specifications for Water Taps and Service Lines", 3/4-inch through 2-inch, with latest addenda and amendments thereto.

D. Backfill trench as soon as possible after pipe has been laid, jointed, and inspected; complete backfilling at end of each day.

E. Within pipe zone: place backfill material and hand tamp in 6-inch layers to one foot above top of pipe.

F. Use of bulldozer or similar tracked equipment is unacceptable for compaction.

3.7 PREPARATION OF SUBGRADE FOR PAVING, WALKS AND EXTERIOR SLABS

A. Cut and fill areas as required.

B. Proof roll sub grade with heavy roller. Cut out any soft area that cannot be compacted by surface rolling and replace with compacted select fill.

C. Provide select fill at areas where required to elevate sub grade. Lime stabilization: stabilize to depth of 8 inches with lime slurry in accordance with TxDOT Item 260. Subgrade beneath sidewalks shall not be lime stabilized.

D. Compact to not less than 85 to 92% of maximum density in accordance with ASTM D698 as confirmed by testing laboratory; with moisture content for compacted material within +/- 2% of optimum moisture.

E. Maintain site surface drainage during construction.

3.8 ROUGH GRADING

A. Shape sub grade to allow for maximum amount of natural settlement and compaction.

B. Remove debris, roots, branches, stones, in excess of 2 inches in size.

C. Remove subsoil which has been contaminated with petroleum products.

D. Excavate areas, to sub grade elevation, which are to receive paving and sidewalks.

E. Bring sub grade to required levels, profiles and contours, making gradual changes in grade; blend slopes into level areas.

F. Slope grade away from building minimum 2 inches in 10 feet unless indicated otherwise.

G. Cultivate sub grade to a depth of 3 inches where topsoil is to be placed; repeat cultivation in areas where equipment used for hauling and spreading topsoil has compacted sub grade.

H. Maintain site surface drainage during construction.

3.9 SURPLUS MATERIALS

A. Remove surplus subsoil from site.

B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

3.10 CLEAN-UP

C. Remove temporary structures, rubbish, and waste materials from work site daily.

END OF SECTION 31 23 00

SECTION 31 25 00 EROSION & SEDIMENTATION CONTROL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This Section pertains to the provisions for the control of erosion in the construction area and in stockpile areas including seeding, the construction of temporary swales and sedimentation basins as required and shown on the drawings. All areas where existing vegetation and grass cover have been bared by construction activities shall be protected from erosion.

B. Contractor is responsible for meeting all local, state and federal regulations regarding erosion control including the applicable provisions of the National Pollution Discharge Elimination System, Phase II, regulations from the Clean Water Act.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Drawings and general provisions of the Contract, including A-Procurement and Contracting Requirements, Division 00 and Division 01 apply to this section.

B. Section 31 11 00 Clearing and Grubbing

C. Section 31 23 00 Grading Excavation and Fill

D. Section 33 05 28 Trenching and Backfill for Utilities

E. Texas Department of Transportation's Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges (2014)

1.3 PERMITS (NOT USED)

1.4 APPLICABLE PUBLICATIONS (NOT USED)

1.5 PROTECTION OF ADJACENT WORK (NOT USED)

1.6 DEFINITIONS

A. Best Management Practices (BMP's) means physical facilities schedules of activities, prohibition of practices, maintenance procedures, and other management practices , when properly designed, installed, and maintained, will be effective to prevent or reduce the discharge of pollution associated with construction activities. BMP's also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

B. Block Sodding: Sodding for erosion control and for final stabilization shall consist of providing and planting Bermuda grass, San Augustine grass, or other acceptable sod along or across such areas as are designated on the drawings and in accordance with the specification requirements herein outlined.

C. Hydromulch Seeding: Seeding, followed by the application of a mulch erosion control blanket shall consist of preparing the ground, sowing of seeds, application of a fertilizer, and stabilization with mulch consisting of a biodegradable fiber along and across such areas as are designated on the plans and in accordance with these specifications

D. Silt Fence: The reinforced filter fabric barrier consists of geotextile fabric supported by a net reinforced fence stretched across and attached to supporting posts or frame and entrenched. Work shall be performed during construction operations and prior to final stabilization to

control erosion and sedimentation as designated on the plans and in accordance with these specifications.

E. Inlet Protection Barriers: The inlet protection barrier consists of a geotextile fabric (filter fabric) supported by a net reinforced fence structure and constructed around a storm drain inlet, catch basin, or culvert. An alternative design of the inlet protection barrier, as approved by the Engineer, consists of fiber rolls placed around a frame, staked in place (or weighted down with clean gravel bags), and constructed around a storm drain inlet, catch basin or culvert. This work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation. As designated on the plans and in accordance with these specifications.

F. Sediment Basins: A sediment basin is a temporary basin or dam constructed across a waterway or excavated location to intercept sediment-laden runoff and to trap and retain the sediment. A sediment basin is usually installed at points of discharge from drainage areas greater than 5 acres. Work shall be performed during construction operations and prior to final stabilization to control erosion and sedimentation as designated on the plans and in accordance with these specifications.

G. Stabilized Construction Access: This work shall consist of the installation of temporary erosion protection and sediment control stabilized construction access - type I, rock, utilized during construction operations and prior to final stabilization, in accordance with these specifications and construction drawings

H. Rock Filter Dams: Rock filter dams are temporary berms constructed of stone to intercept and slow storm water runoff to retain sediment on the construction site.

1. Depending upon the type of rock filter dam specified in the construction plans as Type 1, 2, 3, or 4, the aggregate fill may be unwrapped, wrapped in twisted hexagonal wire mesh, or confined in a gabion wire basket. Applications of RockFilter Dams are as follows:

a. Type 1 dams may be used at toe of slopes, around inlets, in small ditches, and at dike or swale outlets. Type 1 dams are recommended for erosion and sediment control from a drainage area of 5 acres or less.

b. Type 2 dams may be used in ditches and at dike or swale outlets.

c. Type 3 dams may be used in stream fl

d. Type 4 sack gabions may be used in ditches and smaller channels to form an erosion and sediment control dam

1.7 QUALITY ASSURANCE

A. Codes and Standards: Install and maintain erosion control systems in compliance with all authorities having jurisdiction.

1.8 PROJECT/SITE CONDITIONS (NOT USED)

1.9 SUBMITTALS (NOT USED)

PART 2 – PRODUCTS

2.1 SUSTAINABLE MATERIALS

A. Contractor shall strive to utilize sustainable materials, which include rapidly renewable

materials, regional materials, regionally manufactured materials, regionally extracted materials, recycled contents.

2.2 GRASS

A. Materials for erosion control seeding shall conform to TxDOT Item 164.

B. Materials for erosion control sodding shall conform to TxDOT Item 162.

2.3 FERTILIZER

A. Materials for fertilizing erosion control seeding and/or sodding shall conform to TxDOT Item 166.2

2.4 WATER

A. Use clean potable water for maintaining the grass developed after erosion control seeding and/or sodding. Water shall be reasonably clean and free of oil, salt, acid, alkali, sugar, vegetable matter or other substances injurious to the finished product.

B. Water sources other than the local municipal domestic water supply must be approved by the Owner.

C. If onsite reclaimed water sources are used, tanks and apprentices must be clearly marked with the words “non-potable” water.

2.5 SILT FENCE

A. Geotextile fabric for Silt Fences must meet the TxDOT Departmental Material Specifications DMS 6230 Temporary Sediment Control Fence Fabric.

2.6 STRAW BALES

A. Standard rectangular hay bales bound by baling wire, clean and dry

2.7 INLET PROTECTION BARRIERS

A. Geotextile per 2.5 Silt Fence above.

B. Hardwood Posts shall be 2x2 minimum length 4 feet.

C. Net reinforced fence shall be 2 inch by 4 inch welded wire fabric mesh. The mesh support height shall be the equivalent height, or greater, of the geotextile fabric to be attached.

2.8 STABILIZED CONSTRUCTION ACCESS

A. Materials to be per TxDOT spec section 506.2.E.1 for Type 1

2.9 ROCK FILTER DAM

A. Materials. Geotextile fabric shall consist of a woven monofilament or spunbond nonwoven fibers consisting of long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins. Geotextile fabric shall equal or exceed the following average roll values or as directed by the Engineer:

1. Minimum average roll value.

    a. Elongation – 50 percent.

    b. Grab Strength – 200 pounds.

    c. Puncture Strength – 75 pounds.

    d. UV Stability (retained strength) – 50 percent after 500 hours of exposure.

2. Maximum average roll value.

    a. Apparent Opening Size (AOS) – 0.6 mm/#30 US sieve.

B. Geotextile fabric shall be resistant to commonly encountered soil chemicals, mildew, rot, insects, and deterioration resulting from exposure to sunlight or heat. Geotextile fabric shall provide an expected useable life comparable to the anticipated construction period.

C. Aggregate for the rock filter dams shall consist of crushed stone. Aggregate particles shall be composed of clean, hard, durable materials free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials or organic and injurious matter. Aggregate shall be cubic or rounded form, not elongated, flat, shapes. Spalls, fragments, and chips shall not exceed 5 percent by weight. Crushed concrete shall not be substituted for the crushed stone unless as approved by the Engineer. Aggregate size shall depend upon the type of rock filter dam specified in the construction plans. Aggregate size based on type of rock filter dam is as follows:

1. Type 1: 3 inches to 5 inches, open-graded.

2. Type 2: 3 inches to 5 inches, open-graded.

3. Type 3: 4 inches to 8 inches, open-graded.

4. Type 4: 3 inches to 5 inches, open-graded.

D. Mesh is required for reinforced type rock filter dams. Mesh shall be 20 gauge galvanized double twisted hexagonal wire mesh with 1-inch diameter hexagonal openings. Mesh wire shall be zinc coated prior to being double twisted. Reinforcing spiral binders, lacing wire, and stiffeners shall be made of wire having the same coating material and same wire size as the wire mesh. Gabion wire baskets shall equal or exceed the requirements of the wire mesh.

PART 3 – EXECUTION

3.1 GENERAL

A. Protection

1. Protect benchmarks, monuments, existing structures, existing fences, existing roads, existing sidewalks, existing paving, existing curbs, and other features indicated on Drawings to remain, or not indicated to be removed, from damage and displacement. If damaged or displaced, notify Engineer and correct defects as directed.

2. Protect above and below grade utilities which are to remain.

B. Preparation:

1. Use all means necessary to control dust on and near the work, and on and near off-site storage, and spoil areas, if such dust is caused by performance of the work of this Section, or if resulting from the condition in which Project Site is left by Contractor.

2. Moisten surfaces, as required, to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on Project Site.

C. Install erosion control systems at the site's boundary at locations where stormwater runoff will leave the site prior to starting any clearing, stripping, or earthwork operations

D. Minimize the time areas are to be exposed without vegetative cover.

E. Properly dispose of solid waste, paints, solvents, cleaning compounds, etc.

F. Store construction materials in designated areas away from drainageways and low areas.

G. Provide portable toilets and properly dispose of sanitary sewage.

H. Construct containment berms and utilize drip pans at fuel and liquid storage tanks and containers.

3.2 INSTALLATION OF EROSION CONTROL DEVICES

A. Install erosion control devices to protect adjacent and downstream properties from damage and pollution resulting from erosion caused by the work of this Contract.

1. Implement erosion control measures indicated on drawings and additional erosion control measures necessary to prevent damage to adjacent and downstream properties.

B. Install silt fence located along perimeter of site or grading limits immediately following site clearing operations specified under Division 31 Section 31 11 00 Clearing and Grubbing.

1. Install silt fence fabric from a continuous roll for the length of the silt fence whenever possible to minimize the number of joints.

a. Create joints in fabric by securely fastening fabric at the support post with overlap extending to the next post.

2. Drive support post into ground not less than 18 inches.

3. Excavate a 4-inch-wide by 4-inch-deep trench on up-slope side of silt fence.

a. Line trench with silt fence fabric material.

b. Backfill trench with soil or gravel.

C. Install straw bale fence at completion of grading operations in affected area as indicated on drawings.

1. Install erosion control devices at storm sewer inlets immediately after completion of the storm sewer.

2. Place straw bales in a single row, lengthwise on the contour, and embedded 4 inches into soil.

3. Secure each individual bale in place by stakes or reinforcement bars driven through bales into the ground to a depth of not less than 18 inches.

D. Install inlet protection barriers at curb inlets and at area inlets.

E. Install straw bale fences as ditch checks in drainage ditches.

F. Install Stabilized Construction Access per TxDOT specification 506.4.C.5.

G. Rock filter dams shall be installed so as to prevent downstream deposition of sediment and debris from the construction site. Rock filter dams shall be constructed to meet the following criteria:

1. Type 1:

   a. Non-reinforced.

   b. Height: 18-24 inches

   c. Top width: 2 feet minimum.

   d. Upstream and downstream side slope of dam: 2:1 maximum.

   e. Open graded aggregate 3-5 inches.

2. Type 2:

   a. Reinforced with wire mesh.

   b. Height: 18-36 inches.
   c. Top width: 2 feet minimum.

   d. Upstream and downstream side slope of dam: 2:1 maximum.

   e. Open graded aggregate 3-5 inches.

3. Type 3:

   a. Reinforced with wire mesh.

   b. Height: 36-48 inches.

   c. Top width: 2 feet minimum.

   d. Upstream and downstream side slope of dam: 3:1 maximum.

   e. Open graded aggregate 4-8 inches.

4. Type 4:

   a. Reinforced in a gabion wire basket.

   b. Height: 30 inches minimum.

c. Top width: 2 feet minimum.

d. Upstream and downstream side slopes of dam: none specified.

e. Open graded aggregate 3-5 inches.

5. The separation geotextile fabric and wire mesh shall be sized and placed in accordance with the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The separation geotextile fabric may be omitted only as approved by the Engineer. The separation geotextile fabric and wire mesh shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel prior to aggregate placement. Sack gabions for Type 4 rock filter dams shall be securely staked with wooden or metal stakes to the bottom and side slopes of the ditch or channel, as well.

6. Aggregate fill shall be placed to the width, length, height and slopes in accordance with this specification and the rock filter dam detail and as specified by the type of rock filter dam shown in the construction plans. The height of the dam shall be measured vertically from the existing ground to the top of the filter dam. The length of the dam shall be measured across the top centerline of the dam from embankment to embankment and includes the additional length embedded into the embankment. Width of the dam shall be measured along the top face of the dam.

7. Wire mesh shall be folded upstream side over the aggregate fill and tightly secured to itself on the downstream side using wire tires. Hog rings may be substituted for wire ties.

8. Additional aggregate fill or gravel bags shall be placed and secured at the embedded section to prevent low flows from short circuiting the dam at the adjacent dirt embankment area.

9. The Contractor shall be responsible for periodic reshaping, repairing, and maintaining of rock filter dams as directed by the Engineer.

10. The Contractor is responsible for removal and proper disposal of sediment and debris from the rock filter dam. Removed sediment and debris shall not be allowed to flush into the storm sewer system, waterways, jurisdictional wetlands, or onto adjacent properties. Sediment deposits shall be removed before they reach one-third of the height of the dam. Uncontaminated sediment can be placed at the project spoil site or, if properly handled, spread out to supplement fill requirements. If sediment has been contaminated, then it shall be disposed of in accordance with the applicable federal, state, and local regulations. Offsite disposal shall be the responsibility of the Contractor. Contractor is encouraged to reuse aggregate and wire mesh if remaining materials meet original spec requirements.

3.3 EROSION CONTROL SEEDING

A. Exposed fill and stockpile areas shall be protected from windborne erosion if the phasing of the construction operations is anticipated to leave the exposed fill and stockpile areas unattended for 6 weeks or more. At completion of stockpiling operations, stockpiles shall be shaped and graded to drain. Provide a layer of mulch to all sides of the stockpile to protect the stockpile from windborne erosion.

B. Areas designated on the drawings to be seeded shall be seeded in accordance to the Texas

Department of Transportation Standard Specifications, Item 164, titled "Seeding for Erosion Control". Broadcast seeding method shall be used as described in TxDOT, Item 164.4 unless otherwise instructed.

C. Areas to be seeded with slopes steeper than 10H:1V shall also utilize a soil retention blanket as specified in TxDOT Item 169 Soil Retention Blanket.

3.4 TEMPORARY SWALES

A. Temporary drainage swales shall be provided as required to carry drainage away from the work area to an approved outfall point.

B. Unless otherwise shown on the drawings, swales shall be earthen "V" shaped channels graded to a sufficient depth and slope to carry the anticipated runoff, but at least two (2) feet deep with a slope of 0.1%.

C. Swales not designated to remain in place at the completion of the contract shall be cleaned of any muck, debris and other unsuitable material and filled with approved fill before final grading operations begin.

D. Swales shall have erosion control barriers as required in these specifications.

3.5 FILL AND CUT SLOPES

A. Fill slopes in all cases shall be no steeper than 3:1 unless specifically stated on the plans or approved by the Owner's Geotechnical engineer.

B. When cut slopes exceed 2:1 for depths over three (3) feet, proper bracing and shoring per OSHA requirements shall be used and maintained.

C. For permanent slopes, cut or fill, between 2:1 and 10:1, erosion protection shall be provided with hydromulching seeding, sodding, or other method as approved.

D. Where cut slopes of more than 5 feet deep, extend more than 100 feet in length, contractor shall provide a backfill drain at the top of the slope to ease in drainage and erosion control.

3.6 SEDIMENTATION BASINS

A. Sedimentation ponds shall be provided when designated on the plans.

B. All drainage from cleared areas shall be routed through the sedimentation basin.

C. Contractor will be responsible for the operation and maintenance of the pond during construction.

3.7 MAINTENANCE

A. Check all erosion control measures after each rainfall event to ensure that they are in proper working order.

1. Immediately restore all measures to installed condition.

2. During the course of construction all temporary swales constructed for this contract shall be maintained so as to allow proper drainage from the construction area. Before

Contractor leaves the site at the end of construction, all temporary swales must be reworked to meet final conditions as set forth in the drawings and specifications.

3. The Contractor shall assure that all subwork with other contractors at the site understand the importance of the erosion control features. The Contractor shall require all subcontractors to respect the function of the erosion control features and enlist their coordination in maintaining existing swales and ditches.

B. Inspect silt and straw bale fences at least once a week.

1. Immediately replace damaged portions of the silt fences, including portions which have collapsed, contain tears, have decomposed, or have become ineffective.

2. Remove sediment deposits, as necessary, to provide adequate sediment storage and to maintain the integrity of fences. Dispose of accumulated sediment by spreading over upland areas of the site.

C. Maintain erosion control devices in place, as specified, until completion of the work of this Contract.

1. At completion of work, inspect all systems, make necessary repairs, remove and dispose of all accumulated sediment, and turn completely operable systems over to Owner for continued maintenance.

D. Where necessary for equipment and vehicular access to the work areas, adequately sized culverts shall be installed and maintained to provide the access without disturbing the site drainage.

E. Sedimentation Basins.

1. Contractor shall be responsible for maintaining the pond and the outfall and sediment retarding structure in good working condition throughout the time the pond is to be in operation.

2. When sediment and debris fill the pond to over one third (1/3) its designed capacity, the pond shall be cleaned out.

3. The sediment from the clearing operation shall be stockpiled with like materials per Specification 31 11 00 Clearing and Grubbing. If the material is found to not meet the stockpiling requirements listed in 31 11 00, they must be removed from the site as described in 31 11 00.

3.8 INSPECTIONS

A. Inspect all erosion control systems and devices at least once every seven calendar days.

B. Inspect all erosion control systems and devices within 24 hours of the end of any storm which results in precipitation of 1/2 inch or more.

C. During inspections, locations where stormwater leaves the site shall be inspected for evidence of erosion or sediment deposition.

D. Correct deficiencies within three calendar days.

E. Complete a report of each inspection. Report shall contain the following minimum information:

1. Inspector's name
2. Inspection date
3. Observations of the effectiveness of erosion control systems
4. Actions taken if necessary to correct deficiencies
5. Listing of areas where construction operations have permanently or temporarily stopped
6. Authorized signature

END OF SECTION 31 25 00

SECTION 31 63 29 DRILLED CONCRETE PIERS AND SHAFTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary casing.

B. Concrete materials and mix.

C. Reinforcement.

D. Shaft liner.

1.2 RELATED REQUIREMENTS

A. Section 03 20 00 - Concrete Reinforcing: Requirements for concrete reinforcement.

B. Section 03 30 00 - Cast-in-Place Concrete: Requirements for concrete.

1.3 REFERENCE STANDARDS

A. ACI SPEC-336.1 - Specification for the Construction of Drilled Piers; 2001.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

C. ASTM A252/A252M - Standard Specification for Welded and Seamless Steel Pipe Piles; 2019.

D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

E. ASTM A929/A929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe; 2018.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Installer's qualification statement.

C. Project Record Documents: Record actual locations of piers, pier diameter, and pier length. Accurately record the following:

1. Sizes, lengths, and locations of piers.

2. Sequence of placement.

3. Final base and top elevations.

4. Deviation from indicated locations.

5. Placement and configuration of reinforcement deviations.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of documented experience.

PART 2 PRODUCTS

2.1 MATERIALS

A. Casing: Temporary casings of steel, in accordance with ASTM A283/A283M, Grade C; ASTM A36/A36M; or ASTM A929/A929M; of sufficient strength to withstand handling and drilling stresses, concrete pressures, and surrounding earth and water pressures.

B. Shaft Liner: In accordance with ASTM A252/A252M, Grade 1; single length steel pipe, with plain ends, of diameter and wall thickness indicated.

C. Concrete Materials and Mix: Specified in Section 03 30 00.

D. Reinforcement: Specified in Section 03 20 00; spiral wound.

E. Equipment: Appropriate for dewatering excavated shaft.

PART 3 EXECUTION

3.1 PREPARATION

A. Use placement method which will not cause damage to nearby structures.

B. Notify adjacent and affected land owners and building occupants with 90 days notice before proceeding with the work.

C. Prepare to place piers from existing site elevations.

D. Grade perimeter of pier and shaft area to prevent surface water from draining into soil borings. Provide temporary means and methods, as required, to maintain surface diversion until no longer needed, or as directed by the Architect.

3.2 INSTALLATION

A. Construct piers in accordance with ACI SPEC-336.1.

B. Drill vertical pier shafts and belled bases to diameters and depths indicated.

C. Place steel casings immediately after drilling. Set firmly in place. If casing is to be temporary, install shaft liner with sufficient strength to withstand concrete pressures.

1. Withdrawal of temporary casings is at option of Contractor.

D. Clean shaft and bottom of loose material. Provide temporary means and methods, as required, to remove all water from soil borings as needed, or until directed by the Geotechnical Engineer.

E. Allow inspection of shaft and liner prior to placement of reinforcement and concrete.

F. Place reinforcing steel in accordance with Section 03 20 00.

G. Place concrete in single pour, in accordance with Section 03 30 00 with equipment designed for vertical placement of concrete.

H. Coordinate casing withdrawal with concrete placement so that concrete pressure head exceeds anticipated outside soil and water pressure above bottom of casing at all times during withdrawal.

I. Extend reinforcement for connection of caps.

J. Set tops of piers to elevations indicated.

3.3 TOLERANCES

A. Install piers with maximum variation from location, plumbness, bottom area, diameter, and anchorage locations as specified in ACI SPEC-336.1.

B. Maximum Variation From Vertical: 1 in 48.

C. Maximum Variation From Design Top Elevation: Plus 3 inches, minus 1 inch.

D. Maximum Out-of-Position: 2 inches.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 01 40 00 - Quality Requirements.

B. Perform load tests. See Section 31 09 16.26 for additional requirements.

C. Test Piers: Same diameter and type as specified for other piers, placed in same manner.

D. Accepted test piers may not be used in work.

3.5 UNACCEPTABLE PIERS

A. Unacceptable Piers: Piers that fail, are placed out of position, are below elevations, or are damaged.

B. Provide additional piers or replace piers failing to comply with specified requirements.

END OF SECTION 31 63 29

SECTION 00 01 01.2 ASPHALTIC CONCRETE PAVEMENT

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Surface courses of compacted mixture of coarse and fine aggregates and asphaltic material.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). If the Contract is a Stipulated Price Contract, payment for work in this Section is included in the total Stipulated Price.

1.3 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregates.

B. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

C. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

D. TxDOT Tex-126-E - Molding, Testing, and Evaluation of Bituminous Black Base Material.

E. TxDOT Tex-106-E - Method of Calculating the Plasticity Index of Soils.

F. TxDOT Tex-203-F - Sand Equivalent Test.

G. TxDOT Tex-204-F - Design of Bituminous Mixtures.

H. TxDOT Tex-207-F - Determination of Density of Compacted Bituminous Mixtures.

I. TxDOT Tex-208-F - Test for Stabilometer Value of Bituminous Mixtures.

J. TxDOT Tex-217-F - Determination of Deleterious Material and Decantation Test for Coarse Aggregates.

K. TxDOT Tex-227-F - Theoretical Maximum Specific Gravity of Bituminous Mixtures.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of TSUS Construction Project Division 1 Specifications.

B. Submit certificates that asphaltic materials and aggregates meet requirements of Article 2.1, Materials, of this Section.

C. Submit proposed design mix and test data for each type and strength of surface course in Work.

D. Submit manufacturer's description and characteristics of mixing plant for approval.

E. Submit manufacturer's description and characteristics of spreading and finishing machine for approval.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate

1. Gravel or crushed stone, or combination thereof, that is retained on No. 10 sieve, uniform in quality throughout and free from dirt, organic or other injurious matter occurring either free or as coating on aggregate. Aggregate shall conform to ASTM C 33 except for gradation. Furnish rock or gravel with Los Angeles abrasion loss not to exceed 40 percent by weight when tested in accordance with ASTM C 131.

B. Fine Aggregate

1. Sand or stone screenings or combination of both passing No. 10 sieve. Aggregate shall conform to ASTM C 33 except for gradation. Use sand composed of sound, durable stone particles free from loams or other injurious foreign matter. Furnish screenings of same or similar material as specified for coarse aggregate. Plasticity index of that part of fine aggregate passing No. 40 sieve shall be not more than 6 when tested by Tex-106-E. Sand equivalent shall have a minimum value of 45 when tested by Tex-203-F.

C. Composite Aggregate: Conform to following limits when graded in accordance with ASTM C 136.

GRADATION OF COMPOSITE AGGREGATE	
Sieve Size	Percent Passing
1/2"	100
3/8"	85 to 100
#4	50 to 70
#10	32 to 42
#40	11 to 26
#80	4 to 14
#200	1 to 6*
*2 to 8 when Test Method Tex-200-F, Part II (Washed Sieve Analysis) is used.	

D. Asphaltic Material: Moisture-free homogeneous material which will not foam when heated to 347 degrees F, meeting following requirements:

VISCOSITY GRADE				
TEST	AC-10		AC-20	
	Min.	Max.	Min.	Max.
Viscosity, 140E F stokes	1000	± 200	2000	± 400
Viscosity, 275E F stokes	1.9	-	2.5	-
Penetration, 77E F, 100 g, 5 sec.	85	-	55	-
Flash Point, C.O.C., F.	450	-	450	-
Solubility in trichloroethylene, percent	99.0	-	99.0	-
Tests on residues from thin film oven tests:				
Viscosity, 140E F stokes	-	3000	-	6000
Ductility, 77E F, 5 cms per min., cms	70	-	50	-
Spot tests	Negative for all grades			

1. Material shall not be cracked.

2. Engineer will designate grade of asphalt to use after design tests have been made. Use only one grade of asphalt after grade is determined by test design for project.

2.2 EQUIPMENT

A. Mixing Plant: Weight-batching or drum mix plant with capacity for producing continuously mixtures meeting specifications. Plant shall have satisfactory conveyors, power units, aggregate handling equipment, hot aggregate screens and bins, and dust collectors. Provide equipment to supply materials adequately in accordance with rated capacity of plant and produce finished material within specified tolerances. Following equipment is essential:

1. Cold aggregate bins and proportioning device.

2. Dryer.

3. Screens.

4. Aggregate weight box and batching scales.

5. Mixer.

6. Asphalt storage and heating devices.

7. Asphalt measuring devices.

8. Truck scales.

B. Bins: Separate aggregate into minimum of four bins to produce consistently uniform grading and asphalt content in completed mix.

2.3 MIXES

A. Employ a certified testing laboratory to prepare design mixes. Test in accordance with Tex-126-E or Tex-204-F and Tex-208-F.

B. Density and Stability Requirements:

Percent Density		Percent	HVEEM Stability Percent
Min.	Max.	Optimum	Not Less Than
94.5	97.5	96	35

C. Proportions for Asphaltic Material: Provide 4 to 8 percent of mixture by weight. Aggregate by weight shall not contain more than 1.0 percent by weight of fine dust, clay-like particles, or silt when tested in accordance with Tex-217-F, Part II.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify compacted base course is ready to support imposed loads.

B. Verify lines and grades are correct.

3.2 PREPARATION

A. Prime Coat: Do not apply a tack coat until primed base has cured to satisfaction of Engineer.

B. Tack Coat: Where the mixture will adhere to the surface on which it is to be placed without use of a tack coat, tack coat may be eliminated if approved by Engineer.

C. Prepare subgrade in advance of asphaltic concrete paving operation.

3.3 PLACEMENT

A. Do not place asphaltic mixture when air temperature is below 50 degrees F and falling. Mixture may be placed when air temperature taken in shade and away from artificial heat is above 40 degrees F and rising.

B. Haul prepared and heated asphaltic concrete mixture to the project in tight vehicles previously cleaned of foreign material. Mixture shall be at temperature between 250 degrees F and 325 degrees F when laid.

C. Spread material into place with approved mechanical spreading and finishing machine of screening or tamping type. Use track-mounted finish machine to place base course directly on earth subgrade.

D. Surface Course Material: Surface course 2 inches or less in thickness may be spread in one lift. Spread lifts in such manner that, when compacted, finished course will be smooth, of uniform

density, and will be to section, line and grade as shown. Place construction joints on surface courses to coincide with lane lines or as directed by Engineer.

E. Place courses as nearly continuously as possible. Pass roller over unprotected ends of freshly laid mixture only when mixture has cooled. When work is resumed, cut back laid material to produce slightly beveled edge for full thickness of course. Remove old material which has been cut away and lay new mix against fresh cut.

F. When new asphalt is laid against existing or old asphalt, existing or old asphalt shall be saw cut full depth to provide straight smooth joint.

G. In restricted areas where use of paver is impractical, spread and finish asphalt by mechanical compactor. Use wood or steel forms, rigidly supported to assure correct grade and cross section. Carefully place materials to avoid segregation of mix. Do not broadcast material. Remove any lumps that do not break down readily. Place asphalt courses in same sequence as if placed by machine.

3.4 COMPACTION

A. Begin rolling while pavement is still hot and as soon as it will bear roller without undue displacement or hair cracking. Keep wheels properly moistened with water to prevent adhesion of surface mixture. Do not use excessive water.

B. Compress surface thoroughly and uniformly, first with power-driven, 3-wheel, or tandem rollers weighing from 8 to 10 tons. Obtain subsequent compression by starting at side and rolling longitudinally toward center of pavement, overlapping on successive trips by at least one-half width of rear wheels. Make alternate trips slightly different in length. Continue rolling until no further compression can be obtained and rolling marks are eliminated. Complete rolling before mixture temperature drops below 175 degrees F.

C. Use tandem roller for final rolling. Double coverage with approved pneumatic roller on asphaltic concrete surface is acceptable after flat wheel and tandem rolling has been completed.

D. Along walls, curbs, headers and similar structures, and in locations not accessible to rollers, compact mixture thoroughly with lightly oiled tamps.

E. Compact binder course and surface course to density not less than 93 percent of the maximum possible density of voidless mixture composed of same materials in like proportions.

3.5 TOLERANCES

A. Furnish templates for checking surface in finished sections. Maximum deflection of templates, when supported at center, shall not exceed 1/8 inch.

B. Completed surface, when tested with 10-foot straightedge laid parallel to center line of pavement, shall show no deviation in excess of 1/8 inch in 10 feet. Correct any surface not meeting this requirement.

3.6 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of applicable TSUS Construction Project Division 01 Specifications

B. Minimum of one core will be taken at random locations per 1000 feet per lane of roadway or 500 square yards of base to determine in-place depth and density.

C. In-place density will be determined in accordance with Tex-207-F and Tex-227-F from cores or sections. Other methods of determining in-place density, which correlate satisfactorily with results obtained from roadway specimens, may be used when approved by Engineer.

D. Contractor may, at his own expense, request three additional cores in vicinity of cores indicating nonconforming in-place depths. In-place depth at these locations shall be average depth of four cores.

E. Fill cores and density test sections with new compacted asphaltic concrete.

3.7 NONCONFORMING PAVEMENT

A. Recompact pavement sections not meeting specified densities or replace them with new asphaltic concrete material. Replace with new material sections of surface course pavement not meeting surface test requirements or having unacceptable surface texture. Patch asphalt pavement sections in accordance with procedures established by Asphalt Institute.

B. Remove and replace areas of asphalt found deficient in thickness by more than 10 percent. Use new asphaltic base of thickness shown on Drawings.

C. Replace nonconforming pavement sections.

3.8 UNIT PRICE ADJUSTMENT

A. Unit price adjustments shall be made for in-place depth determined by cores as follows:

1. Adjusted Unit Price shall be ratio of average thickness as determined by cores to thickness bid upon, times unit price bid.

2. Adjustment shall apply to lower limit of 90 percent and upper limit of 105 percent of unit price.

3. Average depth below 90 percent may be rejected by Engineer.

3.9 PROTECTION

A. Do not open pavement to traffic until 12 hours after completion of rolling, or as shown on Drawings.

B. Maintain asphaltic concrete pavement in good condition until completion of Work.

C. Repair defects immediately by replacing asphaltic concrete pavement to full depth.

END OF SECTION 32 12 16

SECTION 32 13 13 PORTLAND CEMENT CONCRETE PAVING

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for providing, placing, curing and protecting Portland cement concrete paving, with or without reinforcement as indicated, constructed on a prepared subgrade.

1.2 QUALITY ASSURANCE

A. Reference Standards Applicable to this Section

1. ACI: American Concrete Institute

a. 301: Specifications for Structural Concrete for Buildings.

b. 316R: Recommendations for Construction of Concrete Pavements and Concrete Bases.

2. ASTM: American Society for Testing and Materials

a. A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (with Supplement + S1).

b. C 150: Specification for Portland Cement Type I or Type II.

c. C 309: Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

d. C 881: Specification for Epoxy-Resin-Base Bonding Systems for Concrete.

e. D 1565: Specifications for Flexible Cellular Materials Vinyl Chloride Polymers and Copolymers (Open-Cell Foam).

f. D 1751: Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient bituminous Types).

g. D 1752: Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

h. D 3405: Specification for Joint Sealants, Hot-Poured, for Portland Cement Concrete Pavement.

3. TxDOT: Texas Department of Transportation.

a. Standard Specifications for Construction of Highways, Streets, and Bridges -- Latest Edition.

b. Item 360, CONCRETE PAVEMENT.

B. Formwork Tolerances

1. Formwork tolerances shall be as specified in ACI 316 R, Chapter 5.

C. Finishing Tolerance

1. The top surface of pavement shall have a Class B tolerance as specified in ACI 316 R, Chapter 12.5 and ACI 301, Chapter 11.9.

D. The Portland Cement Paving Contractor/Subcontractor shall provide Owner with evidence of his/her ability to perform the specified work. This evidence shall be in the form of at least five (5) successfully completed Portland Cement paving projects.

1. This list of projects shall be submitted to Owner prior to any paving operations beginning so that Owner will be able to inspect the quality of workmanship at the site and approve the Contractor/Subcontractor.

1.3 SUBMITTALS

A. The following submittals shall be submitted:

1. Reinforcement Materials

a. As required in Section 032100 - Concrete Reinforcement.

2. Concrete Materials

a. As required in Section 321313.79 – Cast-in-Place Concrete.

3. Joint Materials

a. As required in Section 321319 – Concrete Pavement Joints.

1.4 EXTENDED WARRANTY

A. Manufacturer of joint sealant shall provide at least a 1-year written warranty against material degradation or failure and water and foreign matter infiltration through the joint from the time of written acceptance of the Work. This warranty shall not limit Owner's rights or remedies as may otherwise be afforded under law or statute.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Forms

1. Metal forms, as indicated in ACI 316 R, Chapter 5.

B. Welded Steel Wire Fabric

1. Plain wire fabric, as specified in Section 032100 - Concrete Reinforcement of these Specifications.

C. Reinforcing Steel Bars

1. As specified in Section 032100 - Concrete Reinforcement of these Specifications.

D. Dowel Bars

1. Smooth, ASTM A 615 + S1, Grade 60, new billet steel, coated with a water-resistant lubricant immediately prior to placement of concrete in which unbonded ends of bars are to be embedded.

E. Dowel Bar Sleeves

1. Sleeves, PVC or plastic, slightly larger than dowel bars, closed end, a minimum of 6 in. long, with 1-1/2 in. long compressible insert.

F. Concrete

1. As specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.

G. Membrane Forming Curing Compound

1. ASTM C 309, Type 2, unless otherwise directed.

H. Joint Materials

1. Preformed Expansion Joint Filler: ASTM D 1751, ASTM D 1752, and D 1565.

2. Joint Sealing Material: See Section 321319, Concrete Pavement Joints of these Specifications.

I. Form Coating

1. Commercial formulation form-coating compounds that will neither bond with, stain, nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces. Contractor shall submit sample for approval prior to use.

J. Precast Concrete Wheel Stops

1. Accurately formed and finished, of size and shape as indicated, reinforced and anchored as required. Fabricate wheel stops on Site or substitute approved precast units of like design and dimensions.

K. Epoxy Bonding Grout

1. ASTM C 881, Type I.

PART 3 – EXECUTION

3.1 INSPECTION AND PREPARATION

A. Prepared subgrade shall be proof rolled to check for unstable areas and need for additional compaction. Do not begin paving work until such deficiencies have been corrected and subgrade is ready to receive paving.

B. Loose material shall be removed from the compacted subgrade immediately prior to placing concrete and subgrade shall be uniformly dampened.

3.2 SETTING FORMS

A. Forms shall be set in accordance with the recommendations of ACI 316 R, Chapter 5, and as specified herein.

B. Forms shall be set in sufficient quantity to allow continuous progress of concrete placement, and to ensure that forms shall remain in place not less than 24 hours.

C. Forms shall be cleaned after each use and coated with an approved form release agent prior to each use.

3.3 INSTALLATION OF JOINTS, REINFORCEMENT, AND SEALANT

A. Joints and reinforcement shall be installed in accordance with the recommendations of ACI 316 R, Chapter 6, as specified in Section 032100 - Concrete Reinforcement of these Specifications, and in Section 321319 - Concrete Pavement Joints.

B. Sealant manufacturer's instructions and procedures shall be followed so as not to invalidate the warranty.

3.4 PLACING AND FINISHING CONCRETE

A. Concrete shall be placed and finished in accordance with the recommendations of ACI 316 R, Chapters 10 and 12.5, and as specified in Section 32 13 73.19 - Cast-in-Place Concrete of these Specifications.

3.5 CURING AND PROTECTING CONCRETE

A. Concrete shall be cured in accordance with the recommendations of ACI 316 R, Chapter 11, using the membrane curing method and materials.

B. Protection as recommended in ACI 316 R; Chapter 11 shall be provided until written acceptance by Owner.

3.6 INSTALLATION OF CONCRETE WHEEL STOPS

A. Install concrete wheel stops where indicated and in accordance with manufacturer's installation instructions as required. Where dowels are to be embedded into concrete, embed with epoxy bonding grout.

3.7 FIELD QUALITY CONTROL

A. Coring

1. After the pavement is placed and before final acceptance the Engineer may elect to determine pavement thickness by cores cut from the pavement or direct measurement of the edge thickness. Acceptable pavement thickness shall be deficient by no more than two tenths of an inch. Core holes shall be promptly repaired with concrete conforming to the requirements specified herein by the Contractor at no cost to Owner.

B. Deficient Pavement Price Adjustments

1. Where the average thickness of pavement is deficient in thickness by more than 0.2 inch, but not more than 0.75-inch, payment will be made at an adjusted price as specified in the following table.

Concrete Pavement Deficiency

Deficiency in Thickness Determined by Cores Inches	Proportional Part of Contract Price Allowed
0.00 to 0.20	100 percent
Over 0.20 to 0.30	80 percent
Over 0.30 to 0.40	72 percent
Over 0.40 to 0.50	68 percent
Over 0.50 to 0.75	57 percent

2. Any area of pavement found deficient in thickness by more than 0.75 of an inch but not more than one inch or 1/8 of the plan thickness, whichever is greater, shall be evaluated by the Engineer. If, in the judgment of the Engineer, the area of such deficiency should not be removed and replaced, there will be no payment for the area retained. If, in the judgment of the Engineer, the area of such deficiency warrants removal, the area shall be removed and replaced, at the Contractor's entire expense, with concrete of the thickness shown on the plans. Deficient pavement shall be removed for the full area of the slab between joints, or between pre-established limits.

END OF SECTION 32 13 13

SECTION 32 13 19 CONCRETE PAVEMENT JOINTS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Joints for concrete paving; concrete sidewalks, concrete driveways, curbs, and curb and gutters.

B. Saw-cutting existing concrete or asphalt pavements for new joints.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for street pavement expansion joints, with or without load transfer, is on linear foot basis.

2. Payment for horizontal dowels is on a unit price basis for each horizontal dowel.

3. No separate payment will be made for formed or sawed street pavement contraction joints and longitudinal weakened plane joints. Include payment in unit price for Concrete Paving.

4. No separate payment will be made for joints for Curb, Curb and Gutter, Saw-tooth Curb, Concrete Sidewalks, and Concrete Driveways. Include payment in unit price for Curb and Gutter, Concrete Sidewalks, and Concrete Driveways.

5. Payment will be made for Preformed Expansion Joints on a linear foot basis only when field conditions require that sidewalk be moved adjacent to existing concrete structure (i.e., street, back of curb, etc.).

6. Refer to City of Orange Construction Project Division 1 Specifications for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. ASTM D 994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

C. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. ASTM D 3405 - Standard Specification for Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

E. TxDOT Tex-525-C - Tests for Asphalt and Concrete Joint Sealers

1.4 SUBMITTALS

A. Conform to requirements of Section 01.

B. Submit product data for joint sealing compound and proposed sealing equipment for approval.

C. Submit samples of dowel cup, metal supports, and deformed metal strip for approval. Submit manufacturer's recommendation for placing sealant(s).

PART 2 – PRODUCTS

2.1 BOARD EXPANSION JOINT MATERIAL

A. Filler board of selected stock. Use wood of density and type as follows:

1. Clear, all-heart cypress weighing no more than 40 pounds per cubic foot, after being oven dried to constant weight.

2. Clear, all-heart redwood weighing no more than 30 pounds per cubic foot, after being oven dried to constant weight.

2.2 PREFORMED EXPANSION JOINT MATERIAL

A. Bituminous fiber and bituminous mastic composition material conforming to ASTM D 994 and ASTM D 1751.

2.3 JOINT SEALING COMPOUND

A. Conform joint sealants to one of sealant classes described in this section.

B. Conform hot-poured rubber-asphalt compound to ASTM D 3405.

C. Two-component Synthetic Polymer.

1. Curing is to be by polymerization and not by evaporation of solvent or fluxing of harder particles.

2. Cure sufficiently at average temperature of 25 ± 1 C (77 ± 2 F) so as not to pick up under wheels of traffic in maximum three hours.

3. Performance requirements, when tested in accordance with TxDOT Tex- 525-C, shall meet above curing times and requirements as follows:

Cold-Extruded and Cold-Pourable (Self-Leveling) Specifications	
Property	Requirement
Penetration, 25 C (77 F) 150 g Cone, 5 s, 0.1 mm (in.), maximum	130
Bond and Extension 50%, -29 C (-20 F), 3 cycles: *Dry Concrete Block *Steel blocks (Primed, if recommended by manufacturer) *Steel blocks shall be used when armor joints are specified	Pass Pass
Flow at 70 C (158 F)	None
Water content % by mass, maximum	5.0
Resilience: * Original sample, % min. (cured) * Oven-aged at 70 C (158 F), % min.	50 50
Cold-extruded material only - Cold Flow (10 minutes)	None

4. After bond and extension test, there shall be no evidence of cracking, separation or other opening that is over 3 millimeters (1/8 inch) deep in sealer or between sealer and test blocks.

5. Provide cold-extruded type for vertical or sloping joints.

6. Provide self-leveling type for horizontal joints.

D. Self-Leveling, Low Modulus Silicone or Polyurethane Sealant for Asphaltic Concrete and Portland Cement Concrete Joints. This shall be a single component self-leveling silicone or polyurethane material that is compatible with both asphalt and concrete pavements. The sealer shall not require a primer for bond; a backer rod shall be required which is compatible with the sealant; no reaction shall occur between rod and sealant.

1. When tested in accordance with TxDOT Tex-525-C, self-leveling sealant shall meet following requirements:

Self-Leveling, Low Modulus Silicone or Polyurethane Sealant	
Property	Requirements
Tack Free Time, 25 ± 1 C (77 ± 2 F), minutes	120 maximum
Nonvolatile content, % by mass	93 minimum
Tensile Strength and 24-Hour Extension Test: * Initial, 10-day cure, 25 ± 1 C (77 ± 2 F), kPa (psi) * After Water Immersion, kPa (psi) * After Heat Aging, kPa (psi) * After Cycling, -29 C (-20 F), 50%, 3 cycles, kPa (psi) * 24 Hour Extension	* 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * 21 to 69 (3 to 10) * Pass (All Specimens) After 24 hours, there shall be no evidence of cracking, separation or other opening that is over 3 mm (1/8 in.) deep at any point in the sealer or between the sealer and test blocks.

2.4 LOAD TRANSMISSION DEVICES

A. Smooth, steel dowel bars conforming to ASTM A 615, Grade 60. When indicated on Drawings, encase one end of dowel bar in approved cap having inside diameter 1/16 inch greater than diameter of dowel bar.

B. Deformed steel tie bars conforming to ASTM A 615, Grade 60.

2.5 SUPPORTS FOR REINFORCING STEEL AND JOINT ASSEMBLY

A. Employ supports of approved shape and size that will secure reinforcing steel and joint assembly in correct position during placing and finishing of concrete. Space supports as directed by Project Manager.

PART 3 – EXECUTION

3.1 PLACEMENT

A. When new Work is adjacent to existing concrete, place joints at same location as existing joints in adjacent pavement.

B. If limit of removal of existing concrete or asphalt pavement does not fall on existing joint, saw cut existing pavement minimum of 2 inches deep to provide straight, smooth joint surface without chipping, spalling or cracks.

3.2 CONSTRUCTION JOINTS

A. Place transverse construction joint wherever concrete placement must be stopped for more than 30 minutes. Place longitudinal construction joints at interior edges of pavement lanes using No. 6 deformed tie bars, 30 inches long and spaced 18 inches on centers.

3.3 EXPANSION JOINTS

A. Place 3/4-inch expansion joints at radius points of curb returns for cross street intersections, or as located in adjacent pavement but no further than 80 feet apart. Use no boards shorter than 6 feet. When pavement is 24 feet or narrower, use not more than 2 lengths of board. Secure pieces to form straight joint. Shape board filler accurately to cross section of concrete slab. Use load transmission devices of type and size shown on Drawings unless otherwise specified or shown as "No Load Transfer Device." Seal with joint sealing compound.

3.4 CONTRACTION JOINTS

A. Place contraction joints at same locations as in adjacent pavement or at spaces indicated on Drawings. Place smoothed, painted and oiled dowels accurately and normal to joint. Seal groove with joint sealing compound.

3.5 LONGITUDINAL WEAKENED PLANE JOINTS

A. Place longitudinal weakened plane joints at spaces indicated on Drawings. If more than 15 feet in width is poured, longitudinal joint must be saw cut. Seal groove with joint sealing compound.

3.6 SAWED JOINTS

A. Use sawed joints as alternate to contraction and weakened plane joints. Use circular cutter capable of cutting straight line groove minimum of 1/4 inch wide. Maintain depth of one quarter of pavement thickness. Commence sawing as soon as concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing and prior to initiation of cracks. Once sawing has commenced, continue until completed. Make saw cut with one pass. Complete sawing within 24 hours of concrete placement. Saw joints at required spacing consecutively in sequence of concrete placement.

B. Concrete Saw: Provide sawing equipment adequate in power to complete sawing to required dimensions and within required time. Maintain ample supply of saw blades at work site during sawing operations. Maintain sawing equipment on job during concrete placement.

3.7 JOINTS FOR CURB, CURB AND GUTTER

A. Place 3/4 inch preformed expansion joints through curb and gutters at locations of expansion and contraction joints in pavement, at end of radius returns at street intersections and driveways, and at curb inlets. Maximum spacing shall be 120- foot centers.

3.8 JOINTS FOR CONCRETE SIDEWALKS

A. Provide 3/4-inch expansion joints conforming to ASTM A 1751 along and across sidewalk at back of curbs, at intersections with driveways, steps, and walls; and across walk at intervals not to exceed 36 feet. Provide expansion joint material conforming to ASTM D 994 for small radius curves and around fire hydrants and utility poles. Extend expansion joint material full depth of slab.

3.9 JOINTS FOR CONCRETE DRIVEWAYS

A. Provide 3/4-inch expansion joints conforming to ASTM D 1751 across driveway in line with street face of sidewalks, at existing concrete driveways, and along intersections with sidewalks and other structures. Extend expansion joint material full depth of slab.

3.10 JOINT SEALING

A. Seal joints only when surface and joints are dry, ambient temperature is above 50 degrees F and less than 85 degrees F and weather is not foggy or rainy.

B. Use joint sealing equipment in like new working condition throughout joint sealing operation and be approved by Project Manager. Use concrete grooving machine or power-operated wire brush and other equipment such as plow, brooms, brushes, blowers or hydro or abrasive cleaning as required to produce satisfactory joints.

C. Clean joints of loose scale, dirt, dust and curing compound. The term joint includes wide joint spaces, expansion joints, dummy groove joints or cracks, either preformed or natural. Remove loose material from concrete surfaces adjacent to joints.

D. Fill joints neatly with joint sealer to depth shown. Pour sufficient joint sealer into joints so that, upon completion, surface of sealer within joint will be 1/4 inch above level of adjacent surface or at elevation as directed.

3.11 PROTECTION

A. Maintain joints in good condition until completion of Work.

B. Replace damaged joints material with new material as required by this Section.

END OF SECTION 32 13 19

SECTION 32 13 73.19 SITEWORK CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes furnishing materials and installation of cast-in-place concrete as indicated on the Drawings and/or specified herein.

B. Full cooperation shall be given to other trades to install embedded items. Suitable templates insert and sleeves shall be provided for setting items not placed in the forms.

C. All concrete work shall conform to the requirements of ACI 318-95 and CRSI Standards, unless specifically noted otherwise.

1.2 QUALITY ASSURANCE

A. Prior to starting concrete operations, the Contractor shall name his source of supply for concrete materials and shall submit representative samples and reports of quality tests for approval.

B. The Contractor will engage the services of a recognized independent testing laboratory, approved by the Owner, to perform the following services, (in accordance with ASTM E 329-77) the cost of which shall be paid by the Contractor:

1. Design the concrete mixtures specified, make quality tests of materials, inspect the proportioning and mixing of all concrete for this project.

2. Slump Test, ASTM C-143, shall be taken as often as required to provide the specified consistency to concrete.

3. Cast and test of at least 6 cylinders for each day's pour or for each 100 cubic yards or fraction thereof. Cylinders shall be cured and tested in accordance with ASTM specifications for control tests. Cylinders shall be tested at 7 and 28 days. The Contractor shall provide insulated storage room with heat when necessary to store control cylinders, and a protected, fenced-in space for storage of field cylinders, which approximates the condition of curing of the concrete being sampled.

C. In the event that concrete fails to meet strength requirements of these Specifications, the Engineer may require at no additional cost to the Owner, tests in accordance with the "Standard Methods of Securing, Preparing and Testing Specimens of Hardened Concrete for Compressive and Flexural Strengths", ASTM C42, or order load tests in accordance with Chapter 20 of the ACI Building Code 318-95, to be made on the portions of the structure containing questionable concrete. Suitable appliances and methods of loading and measuring shall be provided by the Contractor. The portions of the structure which are found by the Architect/Engineer to contain defective concrete shall be removed and reconstructed in a satisfactory manner at the Contractor's expense. Concrete strength tests are to conform to Chapter 4 of the ACI Building Code 318-95.

D. The laboratory shall have free access to material stockpiles, batching and mixing plants, and job site. The Contractor shall provide adequate assistance to the laboratory in securing specified samples for tests.

E. Contractor shall give the Owner and laboratory reasonable notice before beginning any pours (at least 24 hours).

F. The laboratory shall supply a daily report of concrete and materials testing and inspection to the Architect, Engineer, Design/Builder, Contractor and Owner.

G. Concrete batched away from the job and delivered in mixer or agitator trucks shall conform to requirements of ASTM C94.

H. Authority and Duties of Laboratory Personnel: Inspectors shall inspect the materials and the manufacture of concrete as specified and shall report to the Owner's Representative, Contractor, Architect and the Engineer the progress thereof. Also, when it appears that the material furnished and the work performed by the Contractor fail to fulfill the specification requirements and contract, the inspector shall direct the attention of the Contractor to such failure or infringement. Such inspection shall not relieve the Contractor of any obligation to furnish acceptable materials or to provide the concrete quality in the structure that is in strict accord with plans and specifications. The inspector are not authorized to revoke, alter, relax, enlarge, or release any portion of the work, but in case of any dispute arising between the inspector and the Contractor as to materials furnished or in the manner of performing the work the inspector shall have the authority to reject materials or suspend the work until the question at issue can be referred to the Engineer. The inspector shall not act as foreman or perform other duties for the Contractor. In no case shall any advice or omission on the part of the inspector relieve the Contractor of responsibility for completing the work in accordance with the plans and specifications and the fulfillment of the contract. The work will be inspected as it progresses, but failure to reject any defective work or materials shall not in any way prevent later rejection when such defect is discovered or obligate the Engineer for final acceptance. Any expense incidental to the investigation and determination of actual quality of any questionable material shall be borne by the Contractor.

I. Sampling and Testing:

1. All materials shall be sampled, tested in accordance with appropriate ASTM Standards, and approved before inclusion in any work on this project.
2. Samples for testing shall be furnished by the Contractor.
3. Rejected material shall be immediately removed from the site.
4. Reinforcing steel shall be tested by heat in shops and by random sampling in the field when required by the Architect/Engineer or Owner.

1.3 SUBMITTALS

A. Shop Drawings: The Contractor is to include as a part of his expense the cost of completely dimensioned concrete shop drawings embracing plans and details, bending diagrams, steel order list, placing diagrams, which service shall be furnished by a structural engineer licensed in the State of the project. No portion of the contract documents shall be reproduced and submitted as shop drawings. The shop drawings shall include the following:

1. Necessary Floor Plans – fully dimensioned plans with all depressions, rises, reinforcing steel, to include placement and accessories.

2. Miscellaneous Items – All other reinforced concrete items shall be drawn at such scale as to give full dimensions, details and reinforcing with accessories as required.

B. All reinforcing shall be detailed, ordered, and fabricated in accordance with the latest ACI Manual of Standard Practice for Detailing Concrete Structures and the CRSI Manual of Standard Practice.

C. Submit Shop Drawings to the Architect for review, prior to release to field. Fabrication of reinforcing steel shall not be started until Drawings have been reviewed and stamped.

D. Prior to the placement of any concrete, design mixes for each type of concrete shall be submitted and approved by the testing laboratory. Mix designs shall include all required and shall include each type of aggregate and admixture to be used.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Concreting shall not be started during rain, sleet or snow and shall not be continued during such weather after having been started except long enough to come to a suitable cutoff point. Concrete placed during rain shall have the cement content increased in the amount of one sack of cement per cubic yard of concrete. All forms and earth forms shall be free of ice and frozen surfaces.

B. No concrete shall be poured unless temperature is 40 degrees and rising or unless special precautions are taken (approved by the Architect). Adequate equipment shall be provided for heating the concrete materials and protecting the concrete during freezing and near freezing weather. All concrete shall have a temperature of between 50 degrees and 90 degrees F when depositing, and shall be maintained within this temperature range for at least 72 hours or for as much time as is required to insure the proper rate of curing. No salt or other chemicals shall be added to prevent freezing. The covering or other method used for temperature protection shall remain in place 24 hours after artificial heat is discontinued. The recommended Practice for Cold Weather Concreting" (ACI 306) and the "Recommended Practice for Hot Weather Concreting" (ACI 305) shall be accepted as good practice.

PART 2 – PRODUCTS

2.1 MATERIALS

A. All materials shall be subject to approval. Any change of materials specified shall be submitted for approval and such change, if acceptable, shall be used only when specifically authorized in writing.

B. Cement shall conform to the following specifications:

1. Coarse and fine aggregate shall conform to requirements of ASTM C33 or Federal Specification SS-S-281a.
2. All coarse aggregates shall be crushed limestone.
3. The maximum size of coarse aggregate shall not be larger than 1", 1/5 of the narrowest dimension between forms of the member for which the concrete is to be used, nor larger than ¾ the minimum clear spacing between reinforcing bars. Coarse aggregate for all concrete exposed to the weather shall be crushed limestone with a #57 gradation.
4. Absorption in coarse aggregate shall not exceed 5%.
5. The fineness modulus for fine aggregate used shall not vary more than 0.2 from the approved sample without approval. Fineness modulus to be 2.9.

C. All concrete shall be normal weight unless specifically noted otherwise.

1. Normal weight concrete shall be approximately 145 to 155 pounds per cubic foot.
2. Lightweight concrete shall not exceed 110 pounds per cubic foot and shall be made of normal and normal weight fines.

D. Water shall be clean, fresh, and free from injurious amounts of oils, acids, alkali or organic material or other substances that may be deleterious to concrete or steel.

E. Non-shrink grout shall be factory pre-mixed non-shrink, non-metallic grout containing mineral aggregate and shall require only the addition of water at the site. Grout shall be “EUCO NS” (non-metallic) as manufactured by the Euclid chemical company. “Masterflow 713” (non-metallic) as manufactured by Master Builders or approved equal. The grout shall conform to ASTM C-1107 and CRD-621, “Corps of Engineers Specifications for Non-Shrink Grout,” and shall be tested in accordance with ASTM C827.

F. Waterstops shall be 9” Dumbbell type, Model No. 751 as manufactured by Greenstreak, at locations shown on drawings.

2.2 QUALITY AND PROPORTIONING

A. It shall be the Contractor’s responsibility to furnish concrete which will conform to the quality and strength specified.

B. Strengths, unless otherwise indicated on plans or in specifications or in the table below, shall be 3000 psi minimum 28-day compressive strength.

1. Exterior Concrete 4000 psi

C. Proportioning shall follow the limiting factors in the following table:

1. Proportioning on the basis of field experience shall conform to Section 5.3 of ACI 318-89 or the maximum water/cement ratio in Section 5.4 of ACI 318-89.

D. Proportioning and design mixes shall be established to produce average strengths higher than specified by the amounts specified in Chapter 5 of ACI 318-95.

E. Admixtures:

1. Calcium Chloride shall not be used.

2. An approved air-entraining agent (ASTM C260) shall be added at the mixer with accurate dispenser to produce entrained air 4-6% by volume in all concrete subject to weathering conditions.

3. An approved water-reducing agent equal to those manufactured by mixer with an accurate dispenser.

4. These and other admixtures shall be used only with specific approval. Tests for design mixes shall be made with the admixtures included.

5. Fly ash shall not be permitted.

F. The concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around reinforcement without permitting materials to segregate or free water to collect on the surfaces. Within the limiting requirements the Contractor shall adjust the consistency of the concrete as may be necessary to produce mixtures which will be placeable with reasonable methods of placing and compacting. The Contractor shall maintain on the job at all times adequate extra cement to be used at the rate of ½ sack cement per cubic yard concrete for each 2" slump increase for corrections due to wetness desired or obtained. No water shall be added to concrete except under the direct supervision of the engineer or his appointed representative. Under no circumstances will the addition of more than 2 gallons of water per cubic yard of concrete be allowed at the site.

G. Measurement of Materials:

1. Cement shall be measured by the sack or half-sack unless cement is weighed for each batch.

2. Aggregates shall be proportioned separately by weight with proper compensation for weight of moisture; weighing equipment shall be accurate within 1%.

3. Water shall be measured by an approved device capable of accurate measurement to one pint.

H. Concrete shall be from a single source for each major pour.

2.3 REINFORCEMENT

A. Refer to Section 032100 for requirements for reinforcement.

2.4 EXPANSION MATERIALS

A. Verify compatibility of joint filler with sealant specified.

B. All expansion joints on grade shall be pre-formed non-extruding resilient type, bituminous or bonded cork (ASTM D994 or ASTM D1751).

C. Other expansion joints may comply with ASTM D1752 – "Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction." Manufacturer's certification and material submittal are required.

2.5 CURING, SEALING AND HARDENING COMPOUNDS

A. Liquid Curing and Sealing Compounds – General requirements

1. Curing Compounds: Comply with ASTM C 309, Type 1, Class B.

a. Non-yellowing formulation where subject to ultra violet light.

b. Curing and Sealing Compound: Where indicated, providing curing and sealing formulation with long-lasting finish that is resistant to chemicals, oil, grease, deicing salts, and abrasion.

2. Curing and Hardening Compound: Free of waxes, resins or oils; meet water retention requirements of ASTM C 309; penetrate concrete to change free lime to calcium silicate forming a permanently dense, hard surface.

3. The curing compound shall have test data from an independent laboratory indicating a maximum moisture loss of 0.030 grams per square cm. When applied at a coverage rate of 300 square feet per gallon. Manufacturer's certification is required.

   a. Provide L&M "dress & Seal 30" or Master Builders "Masterseal 66."

   b. Dissipating Resin Curing Compound: The compound shall be a dissipating resin type compound, conforming to ASTM C309, Type I, "Kurez DR" by The Euclid Chemical Company or approved equal. The film must chemically break down in a two to four week period after application.

4. Curing compounds shall not be used on any surface against which additional concrete or other cementious material are to be bonded.

1. Submittal is required.

PART 3 – EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until satisfactory conditions have been corrected.

3.02 CONDUITS, HANGERS, SUPPORTS, ANCHORS, ETC.

A. The Contractor shall see that all necessary bolts and anchors of all other trades employed on this structure including conduits, sockets, inserts, sleeves, etc., will be placed by their respective trades or shall himself place them to details before concreting a given section of work. He shall see that these items do not interfere with the reinforcement.

B. No aluminum conduit or product containing aluminum or any other material detrimental to concrete shall be embedded in concrete.

C. All openings in slabs, beams, columns, and footings, which are not shown on the structural plans, must be approved by the Engineer. The maximum diameter of embedded pipes or conduit shall be 1/3 times the slab or wall thickness. The minimum center-to-center spacing of embedded pipes or conduits shall be three times the outside diameter. For pipes or conduits of different diameters, the minimum edge-to-edge spacing shall be two times the smaller diameter.

D. All pipes and conduits providing flow able material conveyance which penetrate beams, footings, or walls shall be provided with sleeves of an appropriate size and material to provide movement for expected settlements or deflections.

3.3 PREPARATION

A. Concrete placing shall not be started until all necessary preparations have been completed and approval has been given. Preparations shall consist of completing all form work involved, placing all reinforcing steel, pipes, conduits, sleeves, hangers, anchors, fastening devices, waterproofing and such other work to be built into the concrete in the section to be poured, and any other preparations herein required for the concreting operations. Free water and any mud or debris shall be removed from forms and excavations to be occupied by concrete. Approved equipment shall be available on the job site for heating and/or protecting the concrete whenever freezing temperatures are likely to occur within the curing period. Ice or chilled water may be required to control concrete temperature in hot weather to below 90 degrees F.

B. Slabs-on-grade shall be placed on a properly leveled and thoroughly compacted sub grade, equal to 93% maximum dry density. All subsoil's for slabs shall be approved before placing concrete.

C. Approved equipment shall be provided for heating concrete materials and/or protecting the concrete whenever freezing temperatures are likely to occur within curing period.

3.4 INSTALLATION

A. Concrete shall be conveyed from the mixer or transporting vehicle to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of materials or displacement of the reinforcing steel and which will avoid rehandling. For ready-mix concrete in an agitator truck, the elapsed time from mixer to placement shall not exceed 1-1/2 hours.

B. Concrete shall be deposited as nearly as practicable in its final position and shall have the qualities required. Concrete shall be deposited continuously in layers or sections of such thickness that no concrete will be deposited on concrete which has hardened sufficiently to cause seams or planes of weakness. If sections cannot be placed continuously, proper construction joints shall be provided.

C. Concrete during and immediately after depositing shall be thoroughly compacted and worked around reinforcing and embedded fixtures and into all parts of forms by means of spades, rods and approved mechanical vibrators. For thin walls or inaccessible portions, concrete shall be worked into place by vibrating or other approved method: Care shall be taken so as not to work concrete to the point where segregation occurs.

3.5 CONSTRUCTION AND CONTROL JOINTS

A. All horizontal and vertical construction joints shall be intentionally roughened to a full ¼" ± amplitude or have a continuous 2"x 4" keyway along the joint at contractor's option.

B. Provide reinforcing dowels to match the member reinforcing at the joint, unless noted otherwise.

C. Unless indicated otherwise, slabs-on-grade shall have construction or control joints spaced not to exceed 30 times the slab thickness in any direction. All discontinuous control or construction joints shall be reinforced with two (2) #4 x 48". See structural details. Construction joints shall not exceed a distance of 15'-0" O.C. in any direction.

D. Control joints shall be installed in slabs-on-grade so the length-to-width ratio of the slab is not more than 1.25:1. Control joints shall be completed within 12 hours of concrete placement. Control joints may be installed by:

1. Saw Cut to a depth of ¼ the thickness of the slab.
2. Tooled joints shall be made to a depth of ¼ the thickness of the slab.

E. Control joints in visually exposed walls, unless noted otherwise (shall line up with masonry and architectural joints, see drawings):

1. Vertical control joints at 10'-0" O.C.
2. Reinforcing shall be continuous through control and construction joints, unless noted otherwise.
3. Control joints in foundation walls shall line up with masonry control joints.

F. Control joints shall be installed in suspended slabs over steel decking by saw cutting along all interior grid lines. Joints centered above the purlins shall be ¾" deep and shall have #4x5'-0" at 16" O.C. reinforcing placed perpendicular to (and centered on) the purlin. Joints centered above the girders shall be ¾" deep and shall have #4x16'0" O.C. reinforcing placed perpendicular to (and centered on) the girder. The #4 bar reinforcing centered above the grid lines shall be in addition to the specified WWF, which is continuous throughout the suspended slabs over steel decking. Reinforcing shall be placed 1" below the top of the slab.

3.6 FINISHING

A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding ¼" in height rubbed down or chipped off.

B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or surfaces that are covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, damp proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment, not later than one day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

E. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, terrazzo, stone and other bonded applied cementious finish flooring material, and as otherwise indicated. After placing slabs, plane surface to a tolerance not exceeding ½" in 10' when tested with a 10' straightedge. Slope surfaces uniformly to drains where required. After leveling; roughen surface before final set, with stiff brushes, brooms or rakes.

F. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, and as otherwise indicated. After

screening, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding ¼" in 10' when tested with a 10' straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth granular texture.

G. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system. After floating, begin final trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8" in 10' when tested with a 10' straightedge. Grind smooth surface defects, which would telegraph through applied floor covering system.

H. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect and Owner's Representative before application. See Section 321613 – Concrete Curbs and Curb and Gutter.

I. Chemical-Hardener Finish: Apply chemical-hardener finish to interior concrete floors where indicated. Apply liquid chemical-hardener after complete curing and drying of the concrete surface. Dilute liquid hardener with water, and apply in 3 coats; first coat, 1/3-strength; second coat, ½-strength; third coat, 2/3-strength. Evenly apply each coat and allow 24 hours for drying between coats. Apply proprietary chemical hardeners, in accordance with manufacturer's printed instructions. After final coat of chemicalhardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

3.7 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Architect. Cut out honeycomb, rock pockets, voids over ¼" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brushcoat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

B. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

C. Repair of Formed Surfaces: Remove and replace concrete having defective surface if defects cannot be repaired to satisfaction of Architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement cone plugs secured in place with bonding agent.

D. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.

E. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plant to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.

F. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

G. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

H. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Architect.

I. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least ¾" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same material to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finish concrete. Cure in same manner as adjacent concrete.

J. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Grove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry pack, consisting of one-part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact-dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours. Use epoxy-based mortar for structural repairs, where directed by the testing laboratory.

K. Repair methods not specified above may be used, subject to acceptance of Architect.

3.8 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified.

C. Provide moisture curing by following methods:

1. Keep concrete surface continuously wet by covering with water.
2. Continuous water-fog spray.
3. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4” lap over adjacent absorptive covers.

D. Provide moisture-cover as follows:

1. Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3” and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

E. Provide curing compound to slabs as follows:

1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer’s directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.

2. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, liquid floor hardener, waterproofing, damp proofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to Architect.

F. Curing Formed Surfaces: Cure formed concrete surfaces, by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

G. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing compound. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.09 MISCELLANEOUS

A. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

END OF SECTION 32 13 73.19

SECTION 32 16 13 **CONCRETE CURBS AND CURB AND GUTTER**

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for providing, placing, curing, and protecting Portland cement concrete curbs, and combination curbs and gutters, constructed on a prepared subgrade.

1.2 QUALITY ASSURANCE

A. Reference Standards Applicable to this Section

1. ACI: American Concrete Institute

a. 316R: Recommendations for Construction of Concrete Pavements and Concrete Bases.

2. ASTM: American Society for Testing and Materials

a. A 615: Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement (with Supplement + S1).

b. C 150: Specification for Portland Cement Type I or Type II.

c. C 309: Specification for Liquid Membrane - Forming Compounds for Curing Concrete.

d. D 1565: Specifications for Flexible Cellular Materials Vinyl Chloride Polymers and Copolymers (Closed Cell).

e. D 1751: Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient bituminous Types).

f. D 1752: Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

g. D 3405: Specification for Joint Sealants, Hot-Poured, for Portland Cement Concrete Pavement.

3. FS: Federal Specifications and Standards

a. TT-P-86: Paint, Red-Lead-Base, Ready-Mixed.

B. Finishing Tolerance

1. The top surface of curbs and combination curbs and gutters shall have a Class A tolerance as specified in ACI 316 R, Chapter 12.5.

1.3 SUBMITTALS

A. The following Submittals shall be submitted:

1. Reinforcement Materials

a. As required in Section 032100 - Concrete Reinforcement of these Specifications.

2. Concrete Materials

a. As required in Sections 321373.19 - Cast-in-Place Concrete of these Specifications.

1.4 EXTENDED WARRANTY

A. Manufacturer of joint sealant shall provide at least a 1-year written warranty against material degradation and failure and water and foreign matter infiltration through the joint from the time of written acceptance of the Work. This warranty shall not limit LIT rights or remedies as may otherwise be afforded under law or statute.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms

1. Either wood or metal, of the size and shape necessary for forming the item, straight and free of warp.

B. Reinforcing Steel Bars

1. As specified in Section 032100 - Concrete Reinforcement of these Specifications.

C. Dowel Bars

1. Smooth, ASTM A 615 + S1, Grade 60, new billet steel, unbonded ends painted with red-lead- base paint, FS TT-P-86, Type I and coated with a water-resistant lubricant immediately prior to placement of concrete in which unbonded ends of bars are to be embedded.

D. Dowel Bar Expansion Caps

1. PVC or plastic cap, slightly larger than dowel bar, closed end, a minimum of 6 in. long, with 1- 1/2 in. long compressible insert.

E. Concrete

1. As specified in Section 321373.19 – Cast-in-Place Concrete of these Specifications.

F. Membrane Forming Curing Compound

1. ASTM C 309, Type 2, unless otherwise directed.

G. Joint Materials

1. Preformed Expansion Joint Filler: Nonextruding and resilient bituminous type, ASTM D 1751.

2. Joint Sealing Material: See Section 321319 of these Specifications.

H. Form Coating

1. Commercial formulation form-coating compound that will not bond with, stain nor adversely affect concrete surfaces and will not impair subsequent treatment of concrete surfaces.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Prepared subgrade shall be inspected for unstable or unsuitable areas and need for additional compaction. Notify the Engineer in writing of such deficiencies. Do not begin curb construction until all such deficiencies have been corrected.

B. Loose and foreign material shall be removed from the compacted subgrade immediately prior to placing concrete, and subgrade shall be uniformly dampened.

3.2 SETTING FORMS

A. Forms shall be set to the line and grade indicated and shall be securely staked to maintain set position during depositing and curing of concrete. The inside form shall be rigidly attached to the outside form.

B. Forms shall be set in sufficient quantity to allow continuous progress of concrete placement and to ensure that forms shall remain in place not less than 24 hours.

C. Forms shall be cleaned after each use and coated with an approved form release agent prior to each use.

3.3 INSTALLATION OF JOINTS, REINFORCEMENT, AND SEALANT

A. Reinforcement shall be installed as indicated on the Drawings and as specified in Section 032100 - Concrete Reinforcement of these Specifications. Joints shall be installed where indicated on the Drawings and in accordance with Section 321319 – Concrete Pavement Joints of these Specifications.

B. Sealant manufacturer's instructions and procedures shall be followed so as not to invalidate the warranty.

3.4 PLACING AND FINISHING CONCRETE

A. Concrete shall be placed and finished as specified in Section 32 13 73.19 - Cast-in-Place Concrete of these Specifications, and ACI 316 R, Chapters 10 and 12.5.

B. After concrete has been struck off and has sufficiently set, the exposed surfaces shall be worked with a wood float. The exposed edges shall be rounded using an edging tool.

C. After form removal, the surfaces of the curb or combination curb and gutter shall be plastered with a mortar consisting of one-part Portland Cement and two parts fine aggregate. Mortar shall be applied with a template constructed to the shape and dimensions of the item to be plastered. All exposed surfaces shall be brushed to a uniform smooth texture.

3.5 CURING AND PROTECTING CONCRETE

A. Concrete shall be cured in accordance with the recommendations of ACI 316 R, Chapter 11, using the membrane curing method and materials.

B. Protection as recommended in ACI 316 R; Chapter 11 shall be provided until written acceptance by the Engineer.

END OF SECTION 32 16 13

SECTION 32 31 15 CHAIN LINK FENCING AND GATES (COATED)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. PVC-coated chain link fencing, gates, and accessories.

1.02 SUBMITTALS

A. Shop Drawings: Indicate materials, dimensions, details, and finish, show locations and installation procedures. Include details of fence and gate joints, attachments, accessories, footings, and clearances.

B. Product Data: Submit manufacturer's schedules, charts, literature, and illustrations indicating the performance, fabrication procedures, product variations and accessories indicating material compliance and specified options.

C. Samples: Submit color selection of PVC finishes for Architect's selection. If requested, submit samples of materials (i.e., fabric, wires, and accessories).

1.03 QUALITY ASSURANCE

A. Chain link fabric shall have the PVC thermally fused to the galvanized steel core wire. Extruded or bonded and glued chain link fence fabric will not be accepted.

B. Fence framework shall have the PVC thermally fused in compliance with ASTM F1234.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers must have a minimum of five (5) years experience manufacturing chain link fencing and gates meeting or exceeding the following specifications for design, size, gauge, finish of metal parts and fabrication and comply with Division 1 requirements for substitutions in order to be considered.

2.02 CHAIN LINK FENCE MATERIALS

A. Fence Fabric: Height of fence shall be 8’-0” tall

1. PVC coating thermally fused to zinc-coated or zinc-5 percent aluminum-mischmetal alloy-coated steel core wire: ASTM F668 Class 2b, 7 mil thickness thermally fused. Core wire tensile strength 75,000 psi.

2. Size: Helically wound and woven to height of six (6) feet with two (2) inch diamond mesh, with core wire diameter of 0.148 inch (9 gauge) and a break load of 1290 IV.

3. Color: ASTM F934, Black.

4. Selvage of fabric shall be knuckled at top and knuckled at bottom.

B. Fence Framing:

1. Steel pipe - Type 1: ASTM F1083, standard weight schedule 40; minimum yield strength of 25,000 psi; sizes as indicated below. Hot-dipped galvanized with minimum average 1.8 oz/ft^2 of coated surface area.

a. Line posts: 1.90 inch o.d. up to 6 feet on center; 2.375 inch o.d. up to 10 feet on center.
b. Terminal, End, Corner, and Pull posts: 2.375 inch o.d. up to 6 feet on center; 2.975 inch o.d. up to 10 feet on center
c. Rails and Braces: 1.660 inch o.d.

2. PVC finish: In accordance with ASTM F1043, apply supplemental color coating of 10 to 15 mils thermally fused PVC in color to match fabric.

C. Fence Accessories:

1. Chain link fence accessories: Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

2. Post caps: Formed steel, cast malleable iron, or aluminum alloy weather tight closure cap for tubular posts. Provide one cap for each post. (Where top rail is used, provide tops to permit passage of top rail.)

3. Top rail and brace rail ends: Formed steel, malleable or cast iron, for connection of rail and brace to terminal posts.

4. Top rail sleeves: 6 inch sleeve allowing for expansion and contraction of top rail.

5. Wire ties: 9 gauge galvanized steel wire for attachment of fabric to line posts. Double wrap 13 gauge for rails and braces. Hog ring ties of 121/2 gauge for attachment of fabric to tension wire.

6. Brace and tension (stretcher bar) bands: Pressed steel.

7. Tension (stretcher) bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of 3/16 inch x 3/4 inch or equivalent fiber glass rod. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

8. Tension wire: Thermally fused vinyl applied to metallic coated steel wire, 7 gauge, diameter core wire with tensile strength of 75,000 psi.

9. Truss rods: Steel rods with minimum diameter of 5/16 inch.

10. Nuts and bolts are galvanized but not vinyl coated. Color coat nuts and bolts with PVC touch up paint, provided by manufacturer, to match adjacent finishes.

2.03 CHAIN LINK SWING GATES

A. Gate frames: Fabricate chain link swing gates in accordance with ASTM F900 using galvanized steel tubular members, 2 inches square, weighing 2.60 lb/ft. Fusion or stainless steel welded connections forming rigid one-piece unit. Vinyl coated frames thermally fused with 10 to 15 mils of PVC in accordance with ASTM 1043. PVC color to match fence.

B. Chain link fence fabric: PVC thermally fused to metallic coated steel wire, ASTM F668, Class 2b, in color, mesh, and gauge to match fence. Install fabric with hook bolts and tension bars at all four (4) sides. Attach to gate frame at not more than 15 inches on center.

C. Hardware materials: Hot dipped galvanized steel or malleable iron shapes to suit gate size. Field coat moveable parts (i.e. hinges, latch, keeper, and drop bar) with PVC touch up paint, provided by manufacturer, to match adjacent finishes.

D. Hinges: Structurally capable of supporting gate leaf and allow opening and closing without binding. Non-lift-off type hinge design shall permit gate to swing 180 degrees inward.

E. Latch: Forked type capable of retaining gate in closed position and have provision for padlock. Latch shall permit operation from either side of gate.

F. Keeper: Provide keeper for each gate leaf over five (5) feet wide. Gate keeper shall consist of mechanical device for securing free end of gate when in full open position.

G. Double gates: Provide drop rod to hold inactive leaf. Provide gate stop pipe to engage center drop rod. Provide locking device and padlock eyes as an integral part of latch, requiring one (1) padlock for locking both gate leaves.

H. Gate posts: Steel pipe, ASTM F1083, standard weight schedule 40; minimum yield strength of 25,000 psi, 2.875 inches in diameter. Hot-dipped galvanized with minimum 1.8 oz/ft2 of zinc or respective material finished in accordance with ASTM F 1043. PVC color to match fence.

I. Refer to site plan for location and size.

2.04 CONCRETE

A. Concrete for post footings shall have a 28-day compressive strength of 2,500 psi. (17.2 MPa).

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify areas to receive fencing are completed to final grades and elevations. Ensure property lines and legal boundaries of work are clearly established.

3.02 CHAIN LINK FENCE FRAMING INSTALLATION

A. Install chain link fence in accordance with ASTM F567 and manufacturer's instructions.

B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30 degrees or more.

C. Space line posts uniformly at 10 feet on center.

D. Concrete fence post footings:

1. Drill holes in firm, undisturbed or compacted soil. Excavate deeper than specified below as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.

2. Line posts shall be set in 9 inch minimum diameter concrete piers, with a minimum of 33 inches of post embedment in concrete with an additional 3 inch concrete cover at bottom.

3. All end, corner, and pull posts shall be set in minimum 12 inch minimum diameter concrete piers, with a minimum of 33 inches of post embedment in concrete with an additional 3 inch concrete cover at bottom.

4. Place concrete around posts in a continuous pour.

5. Trowel finish around post. Slope to direct water away from posts.

E. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

F. Bracing: Install horizontal pipe brace at mid-height for fences six (6) and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.

G. Tension wire: Provide tension wire at bottom of fabric. Install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12-1/2 gauge hog rings 24 inches on center.

H. Top rail: Install lengths, 21 feet. Connect joints with sleeves for rigid connections for expansion/contraction.

I. Bottom Rails: Install bottom rails between posts with fittings and accessories.

3.03 CHAIN LINK FABRIC INSTALLATION

A. Fabric: Install fabric on security side and attach so that fabric remains in tension after pulling force is released. Leave approximately 2 inches between finish grade and bottom selvage. Attach fabric with wire ties to line posts at 15 inches on center and to rails, braces, and tension wire at 24 inches on center.

B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15 inches on center.

C. Install fencing in accordance with CLFMI recommendations and as follows:

1. Stretch fabric to proper tension between terminal posts and securely fasten to frame. Bottom of fabric shall be held as uniformly as practical to the finished grade.

2. Fasten chain link fabric to fences and backstops securely to terminal posts with 3/16 inch x 3/4 inch tension bars and 11 gauge tie wires, spacing not to exceed 14 inches apart. Tie fabric to top rail with 9 gauge tie wires, spacing not to exceed 24 inches.

3. Fasten chain link fabric to inside of fences of Baseball Fields.

4. Stretch bottom tension wire taut between terminal posts. Securely anchor to each intermediate post 6 inches above grade and secure to fence fabric with hog rings at 24 inches on center.

5. Cap top of all fence posts.

3.04 ACCESSORIES

A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.

B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

3.05 CHAIN LINK SWING GATE POST INSTALLATION

A. Install gate posts in accordance with manufacturer's instructions.

B. Concrete gate post footings:

1. Drill holes in firm, undisturbed or compacted soil. Excavate deeper than specified below as required for adequate support in soft and loose soils, and for posts with heavy lateral loads.

2. All gate posts shall be set in minimum 12 inch minimum diameter concrete piers, with a minimum of 33 inches of post embedment in concrete with an additional 3 inch concrete cover at bottom.

3. Place concrete around posts in a continuous pour.

4. Trowel finish around post. Slope to direct water away from posts.

C. Gate posts and hardware: Set keeper, stops, sleeves into concrete. Check each post for vertical and top alignment, and maintain in position during placement and finishing operations.

3.06 GATE INSTALLATION

A. Install gates plumb, level, and secure for full opening without interference.

B. Attach hardware by means which will prevent unauthorized removal.

C. Adjust hardware for smooth operation.

D. Touch up hardware with PVC touch up paint, provided by manufacturer, to match adjacent finishes.

3.07 CLEANING

A. Clean up debris and unused material, and remove from the site.

END OF SECTION 32 31 15

SECTION 32 31 19 STEEL ORNAMENTAL FENCE SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

The contractor shall provide all labor, materials and appurtenances necessary for installation of the ornamental steel fence system defined herein.

1.02 QUALITY ASSURANCE

The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.03 REFERENCES

- ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
- ASTM D523 - Test Method for Specular Gloss.
- ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
- ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
- ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
- ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
- ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
- ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
- ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

1.06 SUBMITTAL

A. Product Data:
   1. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
   2. Manufacturer's installation instructions.

B. Shop Drawings:
   1. Show locations of footings, sizes of members, and construction details.
   2. Indicate post, foundation, and gate hinge details for the specific installation.

1.07 PRODUCT HANDLING AND STORAGE

Upon receipt at the job site, all materials shall be checked to ensure that no damage occurred during shipping or handling. Materials shall be stored in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.08 PRODUCT WARRANTY

A. All structural fence components (i.e. rails, pickets, and posts) shall be warranted within specified limitations, by the manufacturer as stated in the Montage product warranty. Warranty shall cover any defects in material finish, including cracking, peeling, chipping, blistering or corroding.

B. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufactures warranty shall be guaranteed for five (5) years from date of original purchase.

PART 2 - MATERIALS

2.01 MANUFACTURER – BASIS OF DESIGN

A. AMERISTAR; www.ameristarperimeter.com
   1. Fence System:
      a. Montage II
      b. Style Genesis
      c. 2 rail panel system
      d. Standard bottom rail
      e. 4" standard picket airspace
      f. 6'-0" tall

2.02 MATERIAL

A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft^2 (184 g/m^2), Coating Designation G-60.

B. Material for pickets shall be 1" square x 14 Ga. tubing. The rails shall be steel channel, 1.75" x 1.75" x 12 Ga. Picket holes in the rail shall be spaced (specify 4.334" o.c. for standard picket space or 3.500" o.c. for 3" air space). Fence posts shall be a minimum of 2" square x 16 Ga. Gate posts shall meet the minimum requirements of Table 1.

2.03 FABRICATION

A. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

B. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly (Note: The process produces a virtually seamless, spatter-free good-neighbor appearance, equally attractive from either side of the panel).

C. The manufactured panels and posts shall be subjected to an inline electrode position coating (E-Coat) process consisting of a multi-stage pretreatment/wash, followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). The color shall be Black. The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 (Note: The requirements in Table 2 meet or exceed the coating performance criteria of ASTM F2408).

D. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Residential weight fences under ASTM F2408.

E. Gates shall be fabricated using welded ornamental panel material and gate ends having a 1-1/4" square cross-sectional size. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding.
   1. At gates to receive locking hardware, provide a perforated screen at the door hardware location to prevent the opening of gate by reaching through the fence.

PART 3 - EXECUTION

3.01 PREPARATION

All new installation shall be laid out by the contractor in accordance with the construction plans.

3.02 FENCE INSTALLATION

Fence post shall be spaced according to Table 3, plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer.

3.03 FENCE INSTALLATION MAINTENANCE

A. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces;
   1. Remove all metal shavings from cut area.
   2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
   3. Apply 2 coats of custom finish paint matching fence color.
   4. Use products recommended and acceptable to the manufacturer

3.04 GATE INSTALLATION

Gate posts shall be spaced according to the manufacturers' gate drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected. Type and quantity of gate hinges shall be based on the application; weight, height, and number of gate cycles. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations.

3.05 CLEANING

The contractor shall clean the jobsite of excess materials; post-hole excavations shall be scattered uniformly away from posts.

Table 1 – Minimum Sizes for Montage Gate Post

Gate Leaf	Gate Height	
	Up To & Including 4'	Over 4', Up To & Including 6'
Up To & Including 4'	2" x 16 Ga.	2" x 16 Ga.
Over 4'1", Up To & Including 6'	2" x 16 Ga.	2-1/2" x 16 Ga.
Over 6'1", Up To & Including 8'	2-1/2" x 16 Ga.	2-1/2" x 16 Ga.

Table 2 – Coating Performance Requirements

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 1,000 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822, D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

Table 3 – Montage - Post Spacing By Bracket Type

Span	For CLASSIC, GENESIS, MAJESTIC, WARRIOR, CRESCENT, GEMINI 8’ Nominal (94” Rail)			
Post Size	2”	2”	2”	2”
Bracket Type	Montage Universal (BB102)	Montage Line Boulevard (BB104)	Montage Flat Mount (BB105)	Montage Swivel (BB106)
Post Settings ± ½” O.C.	96-3/4”	96-3/4”	96-3/4”	96-3/4”

* Note: When using BB106 swivel brackets on either or both ends of a panel installation, care must be taken to ensure the spacing between post and adjoining pickets meets applicable codes. This will require trimming one or both ends of the panel.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Piping.
2. Encasement for piping.
3. Manual valves.
4. Pressure-reducing valves.
5. Automatic control valves.
6. Automatic drain valves.
7. Transition fittings.
8. Dielectric fittings.
9. Miscellaneous piping specialties.
10. Sprinklers.
11. Quick couplers.
12. Drip irrigation specialties.
13. Controllers.
14. Boxes for automatic control valves.

1.3 DEFINITIONS

A. Circuit Piping: Downstream from control valves to sprinklers, specialties, and drain valves. Piping is under pressure during flow.

B. Drain Piping: Downstream from circuit-piping drain valves. Piping is not under pressure.

C. Main Piping: Downstream from point of connection to water distribution piping to, and including, control valves. Piping is under water-distribution-system pressure.

D. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be automatic operation with controller and automatic control valves.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For sprinklers, controllers and automatic control valves to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish two (2) sets of extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers that include a State of Texas licensed irrigator or Irrigation Technician on-site at all times.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.10 PROJECT CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

1. Notify Architect or Owner no fewer than five days in advance of proposed interruption of water service.
2. Do not proceed with interruption of water service without Architect's or Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Comply with requirements in the irrigation general notes for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

B. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M, water tube, drawn temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper solder-joint fittings. Furnish wrought-copper fittings if indicated.
2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends.

C. PVC Pipe: ASTM D 1785, PVC 1120 compound, Class 200.

1. PVC Socket Fittings: ASTM D 2466, Schedule 40.
2. PVC Threaded Fittings: ASTM D 2464, Schedule 40.

2.2 PIPING JOINING MATERIALS

A. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

B. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.3 ENCASEMENT FOR PIPING

A. Standard: ASTM D 1785, PVC 1120 compound, Schedule 40.

2.4 MANUAL VALVES

A. Curb Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Amcast Industrial Corporation; Lee Brass Company.
b. Ford Meter Box Company, Inc. (The).
c. Jones, James Company.
d. McDonald, A. Y. Mfg. Co.
e. Mueller Co.; Water Products Division.
f. Red Hed Manufacturing & Supply.

B. Curb-Valve Casing:

1. Standard: Similar to AWWA M44 for cast-iron valve casings.
2. Top Section: Telescoping, of length required for depth of burial of curb valve.
3. Barrel: Approximately 3-inch (75-mm) diameter.
4. Plug: With lettering "WATER."
5. Bottom Section: With base of size to fit over valve.
6. Base Support: Concrete collar.

C. Shutoff Rods for Curb-Valve Casings: Furnish two steel, tee-handle shutoff rod(s) with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve for Project.

D. Brass Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. DynaQuip Controls.
d. Flow-Tek, Inc.; a subsidiary of Bray International, Inc.
e. Hammond Valve.
f. Jamesbury; a subsidiary of Metso Automation.
g. Jomar International, LTD.
h. KITZ Corporation.
i. Legend Valve.
j. Marwin Valve; a division of Richards Industries.
k. Milwaukee Valve Company.
l. NIBCO INC.
m. Red-White Valve Corporation.
n. RuB Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).
c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded or solder joint if indicated.
g. Seats: PTFE or TFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full

E. Bronze Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Crane Co.; Crane Valve Group; Crane Valves.
d. Hammond Valve.
e. Lance Valves; a division of Advanced Thermal Systems, Inc.
f. Legend Valve.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Red-White Valve Corporation.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig (1035 kPa).

c. CWP Rating: 600 psig (4140 kPa).
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded or solder joint if indicated.
g. Seats: PTFE or TFE.
h. Stem: Bronze.
i. Ball: Chrome-plated brass.
j. Port: Full

F. Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Conbraco Industries, Inc.; Apollo Valves.
c. KITZ Corporation.
d. Sure Flow Equipment Inc.
e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-72.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Split body.
d. Body Material: ASTM A 126, gray iron.
e. Ends: Flanged.
f. Seats: PTFE or TFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel.
i. Port: Full.

G. Plastic Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Asahi/America, Inc.
c. Colonial Engineering, Inc.
d. Fischer, George Inc.
e. Hayward Flow Control Systems; Hayward Industrial Products, Inc.
f. IPEX Inc.
g. Jomar International, LTD.
h. KBI (King Bros. Industries).
i. Legend Valve.
j. NIBCO INC.
k. Sloane, George Fischer, Inc.
l. Spears Manufacturing Company.
m. Thermoplastic Valves Inc.
n. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-122.
b. Pressure Rating: 150 psig (1035 kPa).
c. Body Material: PVC.
d. Type: Union.
e. End Connections: Socket or threaded.
f. Port: Full.

H. Bronze Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Valve, Inc.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Crane Co.; Crane Valve Group; Jenkins Valves.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Hammond Valve.
f. KITZ Corporation.
g. Milwaukee Valve Company.
h. NIBCO INC.
i. Powell Valves.
j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
k. Zy-Tech Global Industries, Inc.

2. Description:

a. Standard: MSS SP-80, Type 2.
b. Class: 125.
c. CWP Rating: 200 psig (1380 kPa).
d. Body Material: ASTM B 62 bronze with integral seat and screw-in bonnet.
e. Ends: Threaded or solder joint.
f. Stem: Bronze, nonrising.
g. Disc: Solid wedge; bronze.
h. Packing: Asbestos free.
i. Handwheel: Malleable iron, bronze, or aluminum.

2.5 PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cash Acme; a division of The Reliance Worldwide Corporation.
b. Conbraco Industries, Inc.; Apollo Valves.
c. Honeywell International Inc.
d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description:

a. Standard: ASSE 1003.

b. Body Material: Bronze for NPS 2 (DN 50) and smaller; cast iron for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
c. Pressure Rating: Initial pressure of 150 psig (1035 kPa).
d. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).

B. Water Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. CLA-VAL Automatic Control Valves.
b. Flomatic Corporation.
c. OCV Control Valves.
d. Watts ACV; a division of Watts Water Technologies, Inc.
e. Zurn Plumbing Products Group; Wilkins Water Control Products.

2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve. Include small pilot control valve, restrictor device, specialty fittings, and sensor piping.

a. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
b. Pattern: Globe-valve design.
c. Trim: Stainless steel.
d. Pressure Rating: Initial pressure of 150 psig (1035 kPa) minimum.
e. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.

2.6 AUTOMATIC CONTROL VALVES

A. Bronze, Automatic Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Buckner; a division of Storm Manufacturing Group Inc.
b. Ceres Products Company.
c. Champion Irrigation Products.
d. Netafim USA.
e. Superior Controls Co., Inc.
f. Toro Company (The); Irrigation Division.
g. Weathermatic.

2. Description: Cast-bronze body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

B. Plastic, Automatic Control Valves:

1. Manufacturers: If not shown on plans, subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Buckner; a division of Storm Manufacturing Group Inc.
b. Ceres Products Company.
c. Champion Irrigation Products.
d. Dig Corporation.
e. Greenlawn Sprinkler Company.
f. Hit Products Corporation.
g. Hunter Industries Incorporated.
h. Irritrol Systems.
i. Nelson, L. R. Corporation.
j. Netafim USA.
k. Olson Irrigation Systems.
l. Orbit Irrigation Products, Inc.
m. Rain Bird Corporation.
n. Superior Controls Co., Inc.
o. Toro Company (The); Irrigation Division.
p. Weathermatic.

2. Description: Molded-plastic body, normally closed, diaphragm type with manual-flow adjustment, and operated by 24-V ac solenoid.

2.7 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig (17 to 20 kPa).

2.8 TRANSITION FITTINGS

A. General Requirements: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Cascade Waterworks Manufacturing.
b. Dresser, Inc.; DMD Division.
c. Ford Meter Box Company, Inc. (The).
d. JCM Industries.
e. Smith-Blair, Inc; a Sensus company.
f. Viking Johnson.

2. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

C. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Harvel Plastics, Inc.
b. Spears Manufacturing Company.

2. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Colonial Engineering, Inc.
b. NIBCO INC.
c. Spears Manufacturing Company.

2. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

2.9 MISCELLANEOUS PIPING SPECIALTIES

A. Water Hammer Arresters: ASSE 1010 or PDI WH 201, with bellows or piston-type pressurized cushioning chamber and in sizes complying with PDI WH 201, Sizes A to F.

B. Pressure Gages: ASME B40.1. Include 4-1/2-inch- (115-mm-) diameter dial, dial range of two times system operating pressure, and bottom outlet.

2.10 SPRINKLERS

A. General Requirements: Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Metal, Exposed, Impact-Drive Rotary Sprinklers:

1. Manufacturers: As shown on plans.

C. Plastic, Exposed, Impact-Drive Rotary Sprinklers:

1. Manufacturers: As shown on plans.

D. Plastic, Pop-up, Gear-Drive Rotary Sprinklers:

1. Manufacturers: As shown on plans.

E. Metal, Pop-up, Impact-Drive Rotary Sprinklers:

1. Manufacturers: As shown on plans.

F. Plastic, Pop-up, Impact-Drive Rotary Sprinklers:

1. Manufacturers: As shown on plans.

G. Metal, Surface Spray Sprinklers:

1. Manufacturers: As shown on plans.

H. Plastic, Surface Spray Sprinklers:

1. Manufacturers: As shown on plans.

I. Metal, Surface, Pop-up Spray Sprinklers:

1. Manufacturers: As shown on plans.

J. Plastic, Surface, Pop-up Spray Sprinklers:

1. Manufacturers: As shown on plans.

K. Plastic, Pop-up Spray Sprinklers:

1. Manufacturers: As shown on plans.

L. Metal Shrub Sprinklers:

1. Manufacturers: As shown on plans.
a.

M. Plastic Shrub Sprinklers:

1. Manufacturers: As shown on plans.

2.11 QUICK COUPLERS

A. Manufacturers: As shown on plans.

2.12 DRIP IRRIGATION SPECIALTIES

A. Manufacturers: As shown on plans.

B. Off-Ground Supports: Plastic stakes.

C. Application Pressure Regulators: Brass or plastic housing, NPS 3/4 (DN 20), with corrosion-resistant internal parts; capable of controlling outlet pressure to approximately 20 psig (138 kPa).

D. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.

E. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

F. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.

2.13 CONTROLLERS

A. Manufacturers: As shown on plans.

2.14 BOXES FOR AUTOMATIC CONTROL VALVES

A. Plastic Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. Nationwide Plastics, Inc.
d. NewBasis.
e. Oldcastle, Inc.
f. Orbit Irrigation Products, Inc.
g. USFilter/Plymouth Products, Inc.

2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

a. Size: As required for valves and service.

1) Lettering: "IRRIGATION."

B. Polymer-Concrete Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation.
d. Christy Concrete Products.
e. NewBasis.

2. Description: Box and cover, with open bottom and openings for piping; designed for installing flush with grade.

a. Size: As required for valves and service.

1) Lettering: "IRRIGATION"

C. Drainage Backfill: Cleaned gravel or crushed stone, graded from 3/4 inch (19 mm) minimum to 3 inches (75 mm) maximum.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

B. Install warning tape directly above pressure piping, 12 inches below finished grades, except 6 inches below subgrade under pavement and slabs.

C. Drain Pockets: Excavate to sizes indicated. Backfill with cleaned gravel or crushed stone, graded from 3/4 to 3 inches, to 12 inches below grade. Cover gravel or crushed stone with sheet of asphalt-saturated felt and backfill remainder with excavated material.

D. Provide minimum cover over top of underground piping according to the following:

1. Irrigation Main Piping: Minimum depth of 36 inches below finished grade, or not less than 18 inches below average local frost depth, whichever is deeper.
2. Circuit Piping: 12 inches.
3. Drain Piping: 12 inches.
4. Sleeves: 24 inches.

3.2 PREPARATION

A. Set stakes to identify locations of proposed irrigation system. Obtain Architect's approval before excavation.

3.3 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved on Coordination Drawings.

B. Install piping at minimum uniform slope of 0.5 percent down toward drain valves.

C. Install piping free of sags and bends.

D. Install groups of pipes parallel to each other, spaced to permit valve servicing.

E. Install fittings for changes in direction and branch connections.

F. Install unions adjacent to valves and to final connections to other components with NPS 2 or smaller pipe connection.

G. Install flanges adjacent to valves and to final connections to other components with NPS 2-1/2 or larger pipe connection.

H. Install underground thermoplastic piping according to ASTM D 2774 and ASTM F 690.

I. Install expansion loops in control-valve boxes for plastic piping.

J. Lay piping on solid subbase, uniformly sloped without humps or depressions.

K. Install ductile-iron piping according to AWWA C600.

L. Install PVC piping in dry weather when temperature is above 40 deg F. Allow joints to cure at least 24 hours at temperatures above 40 deg F before testing.

M. Install water regulators with shutoff valve and strainer on inlet and pressure gage on outlet. Install shutoff valve on outlet. Install aboveground or in control-valve boxes.

N. Water Hammer Arresters: Install between connection to building main and circuit valves aboveground or in control-valve boxes.

O. Install piping in sleeves under parking lots, roadways, and sidewalks.

P. Install sleeves made of Schedule 40 PVC pipe and socket fittings, and solvent-cemented joints.

Q. Install transition fittings for plastic-to-metal pipe connections according to the following:

1. Underground Piping:

a. NPS 1-1/2 and Smaller: Plastic-to-metal transition fittings.
b. NPS 2 and Larger: AWWA transition couplings.

2. Aboveground Piping:

a. NPS 2 and Smaller: Plastic-to-metal transition fittings.
b. NPS 2 and Larger: Use dielectric flange kits with one plastic flange.

R. Install dielectric fittings for dissimilar-metal pipe connections according to the following:

1. Underground Piping:

a. NPS 2 and Smaller: Dielectric coupling or dielectric nipple.
b. NPS 2-1/2 and Larger: Prohibited except in control-valve box.

2. Aboveground Piping:

a. NPS 2 and Smaller: Dielectric union.
b. NPS 2-1/2 to NPS 4: Dielectric flange.
c. NPS 5 and Larger: Dielectric flange kit.

3. Piping in Control-Valve Boxes:

a. NPS 2 and Smaller: Dielectric union.
b. NPS 2-1/2 to NPS 4: Dielectric flange.
c. NPS 5 and Larger: Dielectric flange kit.

3.4 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

E. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.

F. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.

G. Copper-Tubing Soldered Joints: Apply ASTM B 813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

H. PE Piping Fastener Joints: Join with insert fittings and bands or fasteners according to piping manufacturer's written instructions.

I. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

J. PVC Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
3. PVC Nonpressure Piping: Join according to ASTM D 2855.

3.5 VALVE INSTALLATION

A. Underground Curb Valves: Install in curb-valve casings with tops flush with grade.

B. Underground Iron Gate Valves, Resilient Seat: Comply with AWWA C600 and AWWA M44. Install in valve casing with top flush with grade.

1. Install valves and PVC pipe with restrained, gasketed joints.

C. Aboveground Valves: Install as components of connected piping system.

D. Pressure-Reducing Valves: Install in boxes for automatic control valves or aboveground between shutoff valves.

E. Throttling Valves: Install in underground piping in boxes for automatic control valves.

F. Drain Valves: Install in underground piping in boxes for automatic control valves.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers after hydrostatic test is completed.

B. Install sprinklers at manufacturer's recommended heights.

C. Locate part-circle sprinklers to maintain a minimum distance of 6 inches from non-pervious boundaries unless otherwise indicated.

3.7 DRIP IRRIGATION SPECIALTY INSTALLATION

A. Install freestanding emitters on pipe riser to mounting height indicated.

B. Install manifold emitter systems with tubing to emitters. Plug unused manifold outlets. Install emitters on off-ground supports at height indicated.

C. Install multiple-outlet emitter systems with tubing to outlets. Plug unused emitter outlets. Install outlets on off-ground supports at height indicated.

D. Install drip tubes with direct-attached emitters on ground.

E. Install drip tubes with remote-discharge on ground with outlets on off-ground supports at height indicated.

F. Install off-ground supports of length required for indicated mounted height of device.

G. Install air relief valves and vacuum relief valves in piping, if needed.

3.8 AUTOMATIC IRRIGATION-CONTROL SYSTEM INSTALLATION

A. Equipment Mounting: Install interior controllers on wall.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

B. Equipment Mounting: Install exterior freestanding controllers on precast concrete bases.

1. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Install control cable in same trench as irrigation piping and at least 2 inches (51 mm) below or beside piping. Provide conductors of size not smaller than recommended by controller manufacturer. Install cable in separate sleeve under paved areas.

3.9 CONNECTIONS

A. Comply with requirements for piping specified in Section 221113 "Facility Water Distribution Piping" for water supply from exterior water service piping, water meters, protective enclosures, and backflow preventers. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, valves, and devices to allow service and maintenance.

C. Connect wiring between controllers and automatic control valves.

3.10 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplates and signs on each automatic controller.

1. Text: In addition to identifying unit, distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Warning Tapes: Arrange for installation of continuous, underground, detectable warning tapes over underground piping during backfilling of trenches. See Section 312000 "Earth Moving" for warning tapes.

3.11 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Any irrigation product will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.12 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Verify that controllers are installed and connected according to the Contract Documents.
3. Verify that electrical wiring installation complies with manufacturer's submittal.

3.13 ADJUSTING

A. Adjust settings of controllers.

B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.

C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with, or not more than 1/2 inch above, finish grade.

3.14 CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

3.15 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain automatic control valves and controllers.

3.16 PIPING SCHEDULE

A. Install components having pressure rating equal to or greater than system operating pressure.

B. Piping in control-valve boxes and aboveground may be joined with flanges or unions instead of joints indicated.

C. Aboveground irrigation main piping, NPS 4 and smaller, shall be one of the following:

1. Purple Type L, Type M hard copper tube, wrought- or cast-copper fittings, and soldered joints.
2. Purple Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

D. Aboveground irrigation main piping, NPS 5 and larger, shall be one of the following:

1. Purple Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.
2. Purple Schedule 80, PVC pipe; Schedule 80, threaded PVC fittings; and threaded joints.

E. Underground irrigation main piping, NPS 3 and smaller, shall be one of the following:

1. Purple Schedule 40, PVC pipe and socket fittings, and solvent-cemented joints.
2. Purple Class 200, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

F. Underground irrigation main piping, NPS 5 and larger, shall be one of the following:

1. Purple NPS 5 and larger ductile-iron, mechanical-joint pipe; ductile-iron, mechanical-joint fittings, glands, bolts, and nuts; and gasketed joints.
2. Purple NPS 5 and larger ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings and gaskets; and gasketed joints.
3. Purple Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
4. Purple Class 200, PVC, pressure-rated pipe; Schedule 80, PVC socket fittings; and solvent-cemented joints.

G. Circuit piping, NPS 2 and smaller, shall be one of the following:

1. Purple Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
2. Purple Class 200, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

H. Circuit piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Purple Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
2. Purple Class 200, PVC, pressure-rated pipe; Purple Schedule 40, PVC socket fittings; and solvent-cemented joints.

I. Underground Branches and Offsets at Sprinklers and Devices: Purple Schedule 80, PVC pipe; threaded PVC fittings; and threaded joints.

1. Option: Plastic swing-joint assemblies, with offsets for flexible joints, manufactured for this application.

J. Risers to Aboveground Sprinklers and Specialties: Type L, Type M hard copper tube, wrought-copper fittings, and soldered joints.

K. Risers to Aboveground Sprinklers and Specialties: Schedule 80, PVC pipe and socket fittings; and solvent-cemented joints.

L. Drain piping shall be one of the following:

1. SIDR 9, 11.5, or 15, PE, controlled ID pipe; insert fittings for PE pipe; and banded or fastener joints.
2. Schedule 40, PVC pipe and socket fittings; and solvent-cemented joints.
3. SDR 21, 26, or 32.5, PVC, pressure-rated pipe; Schedule 40, PVC socket fittings; and solvent-cemented joints.

3.17 VALVE SCHEDULE

A. Underground, Shutoff-Duty Valves: Use the following:

1. As shown on plans.

B. Aboveground, Shutoff-Duty Valves:

1. As shown on plans.

C. Throttling-Duty Valves:

1. As shown on plans.

D. Drain Valves:

1. As shown on plans.

DIVISION 328400 – PLANTING IRRIGATION

END OF SECTION 328400

SECTION 32 90 00 LANDSCAPE PLANTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and General Provisions of the Contract, including General and Supplementary Conditions and all applicable specification sections apply to this section.

1.02 SCOPE OF WORK

A. Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to fine grading, prepared soil mix, supply and planting of trees, shrubs, groundcovers, grass and fertilizing, installation maintenance, clean-up, plant guarantee and replacement and other work related thereto.
B. Protection of existing features. During construction, protect all existing trees and specified vegetation, site features and improvements, structures and utilities as specified on drawings and/or in specifications.
C. Tree stake removal at the 11 month review

1.03 REFERENCE STANDARDS

A. American Joint Committee on Horticultural Nomenclature Standardized Plant Names
B. Texas Association of Nurserymen, Grades and Standards for Nursery Stock.
C. American Standard for Nursery Stock
D. ANSI A300 and Z60.1

1.04 QUALITY ASSURANCE

A. Installation of planting shall be performed by a single company specializing in landscape work. Contractor shall be licensed by the Texas Association of Nurserymen and shall possess an agricultural certificate and licensed pest applicator. Contractor shall have not less than 5 years of experience in this type and scale of work.
B. Contractor to attend a pre-installation meeting with District Representatives, Landscape Architect and others and participate in ongoing meetings during installation with General Contractor and others.

1.05 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted, an Addendum will be issued, otherwise no substitutions are allowed. See Architect for any other requirements.

1.06 SUBMITTALS

Provide the following:

A. Product data and source for all items listed in Materials.
B. Material samples for planting mix, mulch and fertilizer. Samples shall be packaged in plastic bags and shall be typical of the material to be delivered to the site.
C. Color photos of plant material with gallon size indicated, height pole/scale rod (as needed) and plant name with grower and/or nursery source name provided.
D. List the Landscape Contractor responsible for the work on this project.
E. Landscape Architect reserves the right to request purchase and delivery tickets when needed to verify correct variety or material for the project and to reject plant material on site.

1.07 UTILITY VERIFICATION

A. The contractor is responsible for contacting local utility companies for underground line location and verification. If underground lines interfere with planting then Landscape Architect shall be notified to make revisions prior to planting at no additional cost to the owner.

B. The contractor shall be responsible for all damages resulting from failure to comply with this requirement.

PART 2 - MATERIALS

2.01 MATERIAL delivery may begin upon approval of samples or as directed.

A. Topsoil: Contractor responsible for adding topsoil from off-site source if needed. Limited existing topsoil will be available. Existing and off-site borrow soil shall be natural, friable, fertile soil possessing characteristics of the local area. Topsoil is defined as the total amount of soil stripped in the top 4" inches less the vegetative layer. Soil to be free of subsoil, stones, clay, clod, sticks and roots. Topsoil containing nut grass or dallis grass will be rejected. See TOPSOIL specifications for requirements.

B. Mixed soil: If pre-mixed soil is used, an acceptable product is 'Landscaper Mix' by Nature's Way Resources or approved equal.

C. Compost: Compost as manufactured by Nature's Way Resources, Inc. or approved equal. Major nutrients: Nitrogen, Phosphorus, Potassium. Secondary: Calcium, Magnesium, Sulfur. Micronutrients: Iron, Manganese, Zinc, Copper. Materials to be commercially prepared fully composted under sustained temperatures to 165 degrees with a PH averaging 6.5 to 7.0.

D. Commercial Fertilizer: MicroLife 6-2-4 All organic, biological fertilizer as available at San Jacinto Environmental Supplies. No substitutions.

E. Mulch: Landscape finish mulch shall be imported, dark brown in color, shredded hardwood bark used for top dressing and shall have a particle size that passes 100% through a one inch think square mesh and is retained on a 1/8" square mesh.

F. Sand: shall be sharp white sand (not bank sand).

G. Staking material:
1. Landscape fiber strap. ArborTie webbing green in color or equivalent.
2. Stakes shall be sound No. 2 Douglas fir, lodge poles 2-1/2" in diameter, and not less than 7 ft. long, pointed at one end with the slope of the point back about 6" from the end. Stakes shall be cut off square at top after installation to a level of 2" above the straps.
3. Three stakes per tree (45 gallon and larger).
4. Two stakes per tree (30 gallon and smaller).

H. Post-emergent herbicide: Mirimichi Weed & Grass Killer available at San Jacinto Environmental Supplies in Houston, Texas

I. Pre-emergent herbicide: Barricade granular pre-emergent herbicide or approved equal applied to planting beds.

J. Weed Barrier: Pro-5 Weed Barrier 5oz., woven, needle punched, Geotextile polypropylene fabric. Available at San Jacinto Environmental Supplies 2221 West 34th St Houston, Texas

2.02 PLANTS

A. Quality: plants shall be No. 1 grade and true to species, commercial nursery grown in accordance with good horticultural practices under similar climatic conditions similar to those of the project site (approximately 200 miles or less from project site). They shall be fresh, vigorous, of normal growth, free of disease, insects, insect eggs and larva, and have strong root systems. Plant material shall be symmetrical or typical for variety and species and conform to measurements specified in Plant List. **No root bound plant material shall be accepted.**

B. Size: all plants shall equal or exceed the measurements stated in the plant list. Plants shall be measured when branches are in their normal positions. If larger plants are used, then the root ball shall be increased in proportion to the size of the plant.
   1. Caliper measurements shall be taken 6 inches above the natural ground line for trees up to and including 4 inches in caliper and measured 12 inches above the natural ground for trees over 4 inches in caliper.

C. Selection: plants shall be subject to inspection and approval by the Owner at their place of growth and upon delivery for conformation to specification requirements. Such approval shall not impair the right of inspection and rejection during progress of the work.
   1. Trees with multiple leaders, unless specified, will be rejected. Trees with damaged bark, abrasions, crooked leaders, sunscald, disfiguring knots, pruned limbs over ¾" in diameter that are not completely healed will be rejected.

D. Contractor Responsibility: all questions regarding plant material selection, size and specifications will be directed to the Owner's Representative prior to submission of bids. Submission of bids will be understood that the Contractor fully understands the plans and specifications; that all plants and materials will be available in size, character and number at the time of installation. No substitutions will be allowed after bids are received.
   1. The plant list on the drawing is for the contractor's information only and is not guaranteed that quantities therein are correct. The contractor shall be responsible for providing the correct quantities and installation at the correct spacing.

2.03 PLANTING PREPARATION

A. Rock, underground construction work, tree roots, utility conflicts or obstructions encountered in the excavation of tree or shrub pits shall be brought to the attention of the Landscape Architect. Proceed with work after alternate locations have been designated by the Landscape Architect.

B. Layout plants and trees in locations shown on drawings. Use color coded wire and wood stakes. Stake location of each tree and major shrub and outline of shrub and groundcover beds for approval by Landscape Architect.

C. Apply Mirimichi for existing weed elimination only in lawn and planting areas prior to bed prep or planting.

D. All planting beds to be constructed with final grade and mulch below building weep holes. Under no circumstances shall the building weeps be covered. Contractor to bring all related concerns to the Project Manager prior to installation.

PART 3 - EXECUTION

3.01 WORK PROCEDURE

A. Planting Mix for all root zones: all tree and shrub areas shall be backfilled with a prepared

planting mix as follows: 25% parent soil, 25% topsoil, 25% compost, 25% sand (not bank sand).

B. Excavation for container trees shall be twice the width of the container (with angled sides), with natural ground shelf and the depth shall keep the root flare and ball 1”-2” above grade (see detail).
   1. After tree pit excavation, fill hole 2/3 full with water. Water must be absorbed before tree planting. If water is not absorbed within 24 hrs of flooding, let Landscape Architect know. A tree de-watering sump detail will be provided for tree pits holding water.
   2. Ground shelf lift must be in place before tree planting.

C. Excavation for shrub pits shall be the width of the container + 18" and the depth shall keep the root ball 1”-2” above grade (see detail). Lay weed barrier cloth prior to mulch.

D. Excavation for groundcover beds shall include replacement of existing soil (for the entire groundcover bed) with prepared planting mix to a depth of the container (see detail). Spread granular pre-emergent across total planting bed at rates recommended by manufacturer. Apply January 1 – March 20 to target summer weeds and August 15 – September 15 to target winter weeds. All groundcover/ornamental grass beds to have weed barrier installed as well.

E. When plant pits have been backfilled approximately 2/3 full, water thoroughly before installing remaining soil to top of pit, eliminating all air pockets.

F. Lay weed barrier cloth prior to mulch

G. Water all plants immediately after planting.

H. Mulch all planting areas 2”-3" deep immediately after planting.

I. Do not mound mulch against tree trunk.

J. Staking of all trees by Contractor in accordance with plan details. Plants shall stand plumb after staking and all trees shall be staked within 24 hours of planting. Stakes shall be driven into the ground (not root ball) until rigid.

3.02 FINE GRADING

Landscape Contractor will receive the project in a rough grade condition. It is the Landscape Contractor’s responsibility to fine grade the ‘green’ areas; that includes adding topsoil as required to smooth out the rough grade and remove the clumps, clods, dips, ruts, bumps, lumps and removal of construction debris within the ‘green’ areas. Contractor to fine grade and provide positive drainage and even transition to drain inlets.

3.03 CLEAN UP

As planting operations proceed, all rope, wire, empty containers, rocks, clods and all other debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times. After planting operations are finished, all paved areas shall be cleaned by sweeping and washing if necessary.

3.04 INSTALLATION MAINTENANCE

A. Contractor shall maintain the entire limit of landscape work during the course of landscape

installation leading up to and including satisfactory completion of all punch list items.

B. Installation maintenance shall begin immediately after each plant is planted and continue until all punch list items are completed. This includes all watering operations (permanent irrigation, temporary irrigation and hand watering).

C. Installation maintenance shall also include watering, weeding, mowing and edging once a week, weeding, mulching, removal of dead materials, resetting plants to proper grades or upright positions, repairs of soil settlements, dips and depressions, fertilizing and applying sprays or chemicals as necessary to keep the planting and new work free of ants, insects and disease.

D. Once accepted at Substantial Completion, the Contractor shall continue to maintain all landscape items including turf, trees, shrubs, groundcover and all underground irrigation for a period of 60 days starting at the date of punch list completion. See Exterior Landscape Maintenance section.

3.05 PROTECTION

Planting areas and plants shall be protected during installation at all times against trespassing and damage of all kinds until acceptance of the project by the Owner. If any plants become damaged, injured or stolen, they shall be treated or replaced as directed by the Owners Representative at no additional cost to the Owner. The Owner does not assume any responsibility for security until project acceptance.

3.06 INSPECTION AND ACCEPTANCE

A. Substantial Completion notice will be issued only after Owner and Landscape Architect inspect and approve all required planted work including grass areas.

B. All plant material to be alive, healthy and thriving and grass areas established.

C. Acceptance notice will be issued only after Owner and Landscape Architect inspect and approve all planting work as in accordance with Contract Documents but exclusive of replacement of plant materials under the Warranty Period.

3.07 OWNER RESPONSIBILITY

Owner shall take responsibility of the landscape areas by maintaining, monitoring and repairing as needed the irrigation system to ensure the irrigation system remains in working order. Owner shall also fertilize, mow and maintain the landscape in a healthy condition with best practices and industry standards for landscape maintenance.

3.08 WARRANTY PERIOD AND REPLACEMENTS

A. Apart from Natural Act of God occurrences, Contractor shall warrant unconditionally that all trees, shrubs, groundcovers planted under this contract will be healthy and in flourishing condition of active growth for two years from date of Substantial Completion.

B. Any delay in completion of planting operations which extends the planting into more than one planting season will extend the Warranty Period correspondingly.

C. Replace without cost to the Owner, and as soon as weather conditions permit, all dead plants and all plants not in vigorous, thriving conditions as determined by the Owner's Representative during and at the end of the Warranty Period. Plants shall be free of dead or dying branches and branch tips and shall bear foliage of a normal density, size and color. Replacements shall closely match adjacent specimens of the same species and shall be subject to all requirements of this specification.

D. Replacements shall be warranted through one (1) full growing season.

END OF SECTION

SECTION 32 90 30 EXTERIOR LANDSCAPE MAINTENANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Subject to the General and Special Conditions, this Section includes furnishing all labor, materials and equipment necessary to provide a landscape maintenance program including:
1. Running, monitoring, adjustments (both seasonal and plant needs based) and repair to the irrigation system.
2. Watering trees, shrubs and grass areas.
3. Replacement of plants that die.
4. Mowing and edging of landscaping.
5. Monitoring, weeding, and cultivating of plant material.
6. Application of organic fertilizers, insecticides, and herbicides.
7. General site clean up; removal of trash and products of maintenance.
8. Tree stake and supports removal at the end of the 12 month Warranty period.

B. Application of herbicides and pesticides on school facilities is heavily regulated by Texas Department of Agriculture Commercial Applicator. The landscape maintenance contractor shall meet with the school district's IPM (Integrated Pest Management) coordinator prior to the first day of school to discuss responsibilities and methods for complying with TDA documentation and regulation requirements.

1.02 EXTRA SERVICES

A. All services not covered under this contract shall be considered "extra services" and will be charged for separately according to the nature of the item of work. The consent and authorization of the Owner or their authorized representative must be obtained prior to the performance or installation of such "extra services" items and prior to purchase of any chargeable materials.

B. Such work may include by-products of vandalism or other site related work.

1.03 MAINTENANCE REQUIREMENTS

A. Maintenance period shall begin upon satisfactorily completion of punch list items generated from the Substantial Completion Review for the installation of the project. The Contractor shall continue to maintain all landscape items including turf, hydromulch, trees, shrubs, groundcover and all underground and temporary irrigation for a period of 60 days.

B. Watering: Contractor is responsible for all watering (irrigation system operations and maintenance, adjustments, hand watering or temporary irrigation system). Watering shall consist of determining the plant watering requirements, adjustment of schedule and duration for coverage and elevation, and all other work required to maintain living plant material.

C. Trees, Shrubs, Groundcovers and Grass: Maintenance of new planting shall consist of watering, mowing, edging, cultivating, weeding, removal of undesirable volunteer plants, reseeding, mulching, re-staking, re-placing plants, tightening and repairing of guys, resetting

plants to proper grades or upright position, restoration of the planting saucer and furnishing and applying such organic fertilizers, sprays and invigorants as are necessary to keep the plantings free of insects and disease and in thriving condition.

1.04 PROTECTION:

A. Protect planting areas against damage of all kinds for duration of maintenance period. Maintenance may include temporary protection fences, barriers and signs as required for protection. If any plants become damaged or injured, because sufficient protection was not provided, treat or replace as directed by Owner at no additional cost to Owner.

1.05 NEGLECT AND VANDALISM:

A. All plant material that is damaged or killed due to contractors operations, negligence or chemicals shall be replaced at no expense to the Owner. If plant damage or death is caused by conditions beyond the contractor's control, replacement shall be at the Owner's expense, but will need written authorization prior to replacement.

B. All water damage, either natural or man-made; resulting from contractor's neglect shall be corrected at the contractor's expense.

C. All damage to or thefts of landscaping not caused or allowed by the contractor shall be corrected by the contractor at the Owner's expense upon receipt of written authorization to proceed.

1.06 EMERGENCIES

A. Answer emergency or complaint calls regarding conditions in landscaped areas regarding fallen trees, broken water lines or other urgent site conditions and correct the problem or place warning signs and advise the Owner of the need for major work to be performed within 24 hours of the initial contact.

1.07 FINAL ACCEPTANCE

A. Work under this Section will be accepted by Owner’s representative upon satisfactory completion of all work, including maintenance, but exclusive of any required replacement of plant materials. Upon the final acceptance, the Owner will assume responsibility for maintenance of the work.

B. Plant material shall all be in healthy vigorous condition with no signs of stress or declining health.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials required for installed items shall match those already in use including MicroLife organic fertilizer.

2.02 REQUIRED EQUIPMENT

A. Contractor shall furnish the following equipment:

1. Riding lawnmowers
2. Push lawnmowers
3. Line trimmers
4. Miscellaneous hand tools, trimmers, pruners, rakes, brooms, etc.
5. Blowers
6. Others as needed

PART 3 - EXECUTION

3.01 WATERING

A. It shall be the responsibility of the Contractor to assure that the correct watering of plant materials is being accomplished through the following irrigation services:
   1. Regular watering to all new trees.
   2. Regular watering to the shrubs, perennials, ornamental grasses and sodded lawns.
   3. Regular temporary watering for hydromulch areas.
   4. All adjustments for water delivery and all repair of the irrigation system for any and all damage to the system during the course of the maintenance period.
   5. Seasonally adjusting the irrigation controller.

B. The irrigation system will be thoroughly inspected once per month. Check clock setting, clock operation, head elevation and coverage, valve function, backflow preventer, and verify that all heads are intact and secure. Contractor to repair any issues that he finds.

3.02 MAINTENANCE OF SODDED LAWN AND HYDROMULCH

A. Reseed areas as needed to get hydromulch areas growing and water.

B. The Contractor will be responsible for replacing soils that have eroded. Residual soils will be removed and if not mingled with objectionable materials, may be re-used in eroded areas.

C. Immediately upon observing any undesirable volunteer plants or seedlings, contractor shall promptly remove. The Contractor shall initiate a program of mechanical removal and maintain this program throughout the maintenance period.

D. Special effort shall be given to the control of fire ants infesting the site. After control is accomplished, the ant mounds shall be lowered and tamped to the existing grade.

E. Removal of debris from the site unrelated to horticultural maintenance (paper, bottles, cans, "Pirate" signs, etc.) and construction debris shall be the responsibility of the maintenance Contractor. Frequency shall be as per Landscape Maintenance Program.

F. Sod lawn areas shall be mowed and edged as a part of this section. Frequency shall be as per Landscape Maintenance Program. No mowing within 75’-100’ of children outside on site and no mowing during SCHOOL ZONE hours at drop off and pick up.

3.03 MAINTENANCE OF TREES, SHRUBS and GROUNDCOVERS

A. Contractor shall adjust and tighten as required all tree staking and guying.

B. Contractor shall deep water all new trees until there are definite signs the trees have established themselves and are pushing out new growth.

C. Contractor shall trim broken branches and trunk suckers from trees and shrubs. All pruning equipment shall be sharp and clean.

PART 4 - MAINTENANCE FREQUENCY SCHEDULE

4.01 MAINTENANCE OPERATIONS

Month	Minimum Number of Visits per Month
January	2
February	2
March	4
April	4
May	4
June	4
July	4
August	4
September	4
October	3
November	3
December	2

4.02 MULCHING, WEED CONTROL AND GUYING ADJUSTMENT

A. As required at each visit.

4.03 TRASH AND DEBRIS REMOVAL

A. Collect all trash and debris at each visit and dispose of off site.

END OF SECTION

SECTION 32 91 00 TOPSOIL, PLACEMENT AND GRADING

PART 1 - GENERAL

1.01 SCOPE OF WORK

Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to furnishing and placing topsoil for finish grading for seeding, sodding and planting.

1.02 QUALITY ASSURANCE

Contractor to attend a pre-installation meeting and participate in an installation meeting with Owner's Representative.

1.03 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted an Addendum will be issued, otherwise no substitutions are allowed. See Architects for any other requirements.

1.04 SUBMITTALS

A. Contractor shall provide required sample and soil analysis to Landscape Architect prior to delivery of any soil materials to site.
B. Topsoil test report for imported topsoil.
C. MicroLife Humates Plus 0-0-4

PART 2 – PRODUCTS

2.01 TOPSOIL: Contractor responsible for adding topsoil from off-site source if needed. Existing topsoil will be stockpiled by General Contractor for landscape use on site but must be uncontaminated and clean for landscape use.

ASTM D 5268, shall be fertile, friable, natural sandy loam surface soil with a minimum of 4 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth and obtained from excavation or borrow operations having the following characteristics:

1. Ph value between 5.5 and 7.0
2. Liquid limit - topsoil not to exceed 50.
3. Plasticity index - 10 or less
4. Gradation - maximum of 40 % passing the No. 280 sieve.

A. On-site Topsoil Source: Reuse surface soil on-site if approved by Owner's Representative. Verify suitability of existing surface soil to produce topsoil. Supplement with imported or augmented topsoil from off-site sources when quantities are insufficient. Contractor responsible for testing topsoil (existing or imported) for compliance. Topsoil shall be free of subsoil, clay, lumps, weeds, weed seed, non-soil materials and other litter or contamination. Topsoil shall not contain roots, stumps, or stones larger than 1" inch.

Obtain topsoil from naturally well drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of, nut grass or other

noxious weeds or high clay content.

B. Off-site Topsoil Source: Import enriched topsoil or manufactured topsoil from off-site sources. Obtain topsoil from naturally well drained areas where topsoil occurs at a minimum depth of 4 inches and has similar characteristics to that found at the placement site. Do not obtain topsoil from areas infected with a growth of, or reproductive parts of, nut grass or other noxious weeds.

2.02 SCHOOL SITE

A. Solid sod areas (see plan) shall receive 2" inch of topsoil before sodding.
B. Hydromulch areas shall receive 1” inch of topsoil before hydromulch spraying.

2.03 AMENDMENTS

A. MicroLife Humates Plus 0-0-4
B. Compost – if topsoil needs additional organic material.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Coordinate location of stockpile topsoil area with District and Project Manager.
B. Verify that excavation and subgrade operations have been completed to correct lines and grades and have been coordinated and reviewed by District, Project Manager, Civil Engineer and Landscape Architect.

3.02 PLACEMENT

A. Scarify and breakup subgrade.
B. Apply Humates at a rate of 10lbs per 1,000 sq ft. Process must be documented (video/photos) by contractor while applying product.
C. Spread topsoil in lifts according to plan grades.
D. Lightly roll or water topsoil and let topsoil settle.
E. Grade the surface of all areas to meet the grades shown on the civil drawings. Add enough topsoil to allow for settlement so soil will be at correct grades and achieve positive drainage after settlement.
   1. Provide for positive drainage from all areas toward the inlets and drainage structures.
   2. Provide even transitions.
   3. Cut grade where sod meets hydromulch for even level transition from one to the other.
   4. All grading must be reviewed by Project Manager, District, Civil Engineer and Landscape Architect.
   5. Fill all settlement depressions at no additional cost to Owner.
F. Coordinate this operation with irrigation placement and all other trades.

3.03 CLEAN UP

Remove spilled topsoil from paved areas, curbs, gutters, etc. As operations proceed all excess soil and debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times.

3.04 PROTECTION

Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION

SECTION 32 92 00 LAWN SODDING & HYDROMULCH

PART 1-GENERAL

1.01 SCOPE OF WORK

Scope of work under this Section of the specifications shall include all approved materials, labor, equipment, transportation and services required and incidental thereto, in conformity with the plans and specifications, including but not limited to fine grading, hydromulching and sodding areas, fertilizing, installation maintenance, clean-up, guarantee and replacement and other work related thereto. Including:

A. Planting of sod within areas designated on Drawings for purpose of surface stabilization, channel stabilization, vegetation buffer strips or patching and lawn areas.
B. Sod is defined as blocks, squares, strips of turf grass with adhering soil used for vegetative planting. To be placed edge to edge for complete coverage.
C. A double row of sod shall be placed around all inlets within hydromulch areas.
D. A single row of sod shall be placed around all pedestrian surfaces including all walks.
E. Lawn is defined as ground covered with fine textured grass kept neatly mowed.
F. Hydromulch to be applied in all disturbed areas that are not planted with solid sod (including right-of-ways).
G. A shovel cut edge shall divide the Bermuda from the giant Bermuda areas.

1.02 QUALITY ASSURANCE

A. Contractor to attend a pre-installation meeting and participate in an installation meeting with Owner's Representative.
B. Sod certification shall be submitted from the sod nursery as to grass species and stripping date.
C. Seed certification shall be submitted from the supplier for each type of seed specified.

1.03 SUBSTITUTIONS

Substitutions must be submitted 10 days before proposals are due, if accepted, an Addendum will be issued, otherwise no substitutions are allowed. See Architects for any other requirements.

PART 2- PRODUCTS

2.01 Project site includes Bermuda and Giant Bermuda NK-37 hydromulch and Common Bermuda solid sod (see plan for each indicated area).

A. Hydromulch shall be accomplished according to the following schedule:

Summer application (April 1 - September 30) per 1000 square feet
50# wood cellulose fiber mulch
1.5# - 2# hulled Bermuda seed
15# 13-13-13 water soluble fertilizer

Winter application (October 1 - February 14) per 1000 square feet
50# wood cellulose fiber mulch
2#-3# unhulled Bermuda seed
2#-3# hulled Bermuda seed
2# gulf rye seed
15# 13-13-13 water soluble fertilizer

Late Winter/Early Spring application (February 15 - March 31) per 1000 square feet
50# wood cellulose fiber mulch
2#-3# unhulled Bermuda seed
2#-3# hulled Bermuda seed
15# 13-13-13 water soluble fertilizer

Seed shall be certified 90 % pure and conform to the Federal Seed Act and Texas Seed Law.

Hydromulch to be applied at an accelerated schedule in order for the grass to grow prior to the start of school. Hydromulch must achieve full growth prior to Substantial Completion date.

B. Solid sod as called for on plans. Sod shall be certified or nursery/farm grown grass true to the name and variety. Sod shall be substantially free of noxious weeds, disease, insects, thatch and undesirable grasses.

Sod shall be nursery grown and have a healthy root system of dense thickly matted roots throughout the soil of the sod for a minimum thickness of 1 inch. Sod shall be rectangular in size approx 16”x24”.

Schedule deliveries to coincide with topsoil operations and laying. During wet weather allow sod to dry sufficiently to prevent tearing. During dry weather, protect sod from drying out. Water as necessary to insure vitality and to prevent excess loss of soil while handling. Sod which dries out will be rejected. Sod shall be cut delivered and installed within 24 hours of cutting.

C. Fertilizer – Organic Microlife 6-2-4

D. Bank Sand – Free of clay lumps, roots, grass, salt or other foreign material.

E. Humates – MicroLife Humates Plus 0-0-4 applied in ALL hydromulch areas and in TOPSOIL for landscape sod areas (See Topsoil Section 32 92 00)

PART 3 - EXECUTION

3.01 PREPARATION - Grades to be reviewed by District, Project Manager, Civil Engineer and Landscape Architect prior to sodding or hydromulch operations.

A. Protection
1. Take care and preparation in work to avoid conditions which will create hazards. Post signs or barriers as required.
2. Provide adequate means for protection from damage through excessive erosion, flooding, heavy rains, etc. Repair or replace damaged areas.

B. Surface Preparation for hydromulch

1. Remove all existing weeds by hand or herbicide use. Remove top growth and roots.
2. Scarify small areas (less than 500sq ft) by hand raking to 3” deep to remove rocks and construction debris and break up compacted soil.
3. Larger areas to be prepared by removing large debris by hand, then using a Rock rake to loosen soil and remove rocks, then using a Harley rake to push smaller rocks into a pile and remove. Several passes with each type of equipment may be required to reach an acceptable soil condition that is ready for seeding.
4. At each step continue to remove soil clods, rocks, weeds, roots and construction debris above and below grade.

5. Add 1” topsoil and refine grades for positive drainage to area inlets.
6. Create and maintain shovel cut bed edge to separate giant Bermuda from Bermuda hydromulch areas.
7. Grades to be reviewed by District, Project Manager, Civil Engineer and Landscape Architect prior to next phase.

C. Surface Preparation for solid sod

1. Remove all existing weeds by hand or herbicide use. Remove top growth and roots.
2. Scarify small areas (less than 500sq ft) by hand raking to 3” deep to remove rocks and construction debris and break up compacted soil.
3. Larger areas to be prepared by removing large debris by hand, then using a Rock rake to loosen soil and remove rocks, then using a Harley rake to push smaller rocks into a pile and remove. Several passes with each type of equipment may be required to reach an acceptable soil condition that is ready for seeding.
4. At each step continue to remove soil clods, rocks, weeds, roots and construction debris above and below grade.
5. See TOPSOIL section for amended topsoil requirements. Add a minimum of two (2”) inches of topsoil as a setting bed for landscape sod.
6. Refine grades for positive drainage to area drains. Sod areas to be graded to achieve proper final elevations, eliminating all bumps, ridges or depressions to provide for smooth drainage.
7. Grades to be approved by District, Project Manager, Civil Engineer and Landscape Architect prior to sodding.

3.02 INSTALLATION

A. Site Tolerances

Final grade after complete shall be one inch below top of adjacent pavement of any kind. Coordinate with Civil drainage plans for possible conflicts, such as sheet drainage across sidewalks, etc. Bring all conflicts to the Project Managers attention for resolution.

B. Hydromulch

1. Apply Humates at a rate of 10lbs per 1,000 sq ft Lightly rake to incorporate into soil. Process must be documented (video/photos) by contractor while applying product.
2. Add 1” inch of topsoil and fine grade
4. Apply seed with approved spray equipment and water (to keep moist) seeded areas.
5. Hydromulch to be applied at an accelerated schedule in order for the grass to grow prior to the start of school.
6. Reseed areas that do not show prompt germination. Bare areas must be less than 12" in any direction.
7. Hydromulch must achieve full growth prior to Substantial Completion date.

C. Solid sod

1. Lay sod in rows with staggered joints. Butt sections closely without overlapping or leaving gaps between sections. Topdress/Sand fill sod joints.
2. Lay single row of sod along all pedestrian walks within hydromulch areas.
3. Lay a double row of sod around inlet drains within the hydromulch areas.
4. Cut sod where sod meets hydromulch for an even transition from one area to the other.
5. Sod blocks shall not prevent drainage away from the walk or create ponding issues.
6. On all slopes and detention pond, lay sod perpendicular to slope and secure every row with metal 2 pronged staples at a maximum of 2 feet on center. Drive staples flush with soil portion of sod.
7. Roll sodded areas in two directions perpendicular to each other. Repair and reroll

areas with depressions, lumps or other irregularities.

8. Fertilize sod areas (dependant on time of year).
9. Water sodded areas immediately after sod laying to obtain moisture penetration through sod into top four (4") inches of soil.

3.03 CLEAN UP

As planting operations proceed, all rope, wire, empty containers, rocks, clods and all other debris shall not be allowed to accumulate, but shall be removed daily and the site kept as tidy as possible at all times. After planting operations are finished, all paved areas shall be cleaned by sweeping and washing if necessary.

3.04 PROTECTION

Planting areas shall be protected during installation at all times against trespassing and damage of all kinds until acceptance of the project by the Owner.

3.05 INSTALLATION MAINTENANCE

A. Contractor shall maintain the entire limit of landscape work during the course of landscape installation leading up to and including satisfactory completion of the Substantial Completion Review punch list.
B. Installation maintenance shall begin immediately after hydromulching or sodding and continue until all Substantial Completion punch list items are completed. Installation maintenance includes all watering operations (permanent irrigation, temporary irrigation and hand watering). Contractor is responsible for temporary and/or hand watering for hydromulch establishment.
C. Hydromulch must achieve full growth with bare areas less than 12” in any direction.
D. Installation maintenance shall include watering, weeding, mowing and edging once a week, reseeding, removal of dead materials, repairs of soil settlements, dips and depressions, fertilizing and applying sprays or chemicals as necessary to keep the grass free of insects and disease.
E. Once accepted at Substantial Completion, the Contractor shall continue to maintain all landscape items including turf, trees, shrubs, groundcover and all underground irrigation for a period of 60 days starting at the date of punch list completion. See Exterior Landscape Maintenance section.

3.06 INSPECTION AND ACCEPTANCE

Work under this Section will be accepted by the Owner's Representative upon satisfactory completion of all work and "punch list" items generated by Substantial Completion review.

3.07 WARRANTY PERIOD AND REPLACEMENTS

Contractor shall warrant unconditionally that grass planted under this contract will be healthy and in flourishing condition of active growth for one year from date of Substantial Completion.

Any delay in completion of planting operations which extends the planting into more than one season will extend the Warranty Period correspondingly.

Replace without cost to the Owner, and as soon as weather conditions permit, all dead grass as determined by the Owner’s Representative during and at the end of the Warranty Period. Replacements shall be warranted through one full growing season.

END OF SECTION

SECTION 33 05 16 **UTILITY STRUCTURES**

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Excavation and backfill.

B. Cast-in place concrete structures.

C. Precast concrete structures.

D. Metal components.

1.2 RELATED SECTIONS

A. Concrete formwork, concrete reinforcement, cast-in-place concrete, Portland cement concrete, concrete repair and finishing, and precast concrete are specified in the various Sections under Division 3 - Concrete.

B. Interior trench drains and gratings for interior uses are specified in Submittals.

C. Duct banks are specified per submittals for Facility Services.

1.3 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for utility structures will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for utility structures indicated in the Bid Schedule of the Bid Form.

B. Lump Sum: If the Bid Schedule indicates a lump sum for utility structures, the lump-sum method of measurement and payment will be in accordance with Section 01, Article 1.03.

C. Unit Price: If the Bid Schedule indicates a unit price for utility structures, the unit-price method of measurement and payment will be as follows:

1. Measurement:

a. Cast-in-place concrete and precast concrete units or structures and metal curb-and-gutter inlets will be measured for payment by the individual unit (each), installed in place. Each different type and size of concrete unit or structure will be measured separately for payment.

b. Manhole covers and frames, grates and frames, pipe inlets and outlets, manhole steps, ladders, miscellaneous metal, reinforcing steel, and grounding will not be measured separately for payment, but will be included as part of the utility structure to which it is attached or embedded.

c. Excavation and backfill for utility structures will be measured separately for payment as specified in Section 31 00 00 - Earthwork, as applicable.

2. Payment:

a. Utility structures will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1, herein.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1.	ASTM A36/A36M	Specification for Structural Steel
2.	ASTM A48	Specification for Gray Iron Castings
3.	ASTM A108	Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality
4.	ASTM A123	Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
5.	ASTM A153	Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
6.	ASTM A536	Specifications for Ductile Iron Castings
7.	ASTM B3	Specification for Soft or Annealed Copper Wire
8.	ASTM B26/B26M	Specification for Aluminum-Alloy Sand Castings
9.	ASTM C33	Specification for Concrete Aggregates
10.	ASTM C150	Specification for Portland Cement
11.	ASTM C260	Specification for Air-Entraining Admixtures for Concrete
12.	ASTM C270	Specification for Mortar for Unit Masonry
13.	ASTM C478	Specification for Precast Reinforced Concrete Manhole Sections
14.	ASTM C618	Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
15.	ASTM C789	Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
16.	ASTM C850	Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 feet of Cover Subjected to Highway Loadings

17. ASTM C858 Specification for Underground Precast Concrete Utility Structures

18. ASTM C891 Practice for Installation of Underground Precast Concrete Utility Structures

B. Underwriters Laboratories Inc. (UL):

1. UL 467 Grounding and Bonding Equipment

1.5 SUBMITTALS

A. General: Refer to Section 01, for submittal requirements and procedures.

B. Shop Drawings: When not indicated on the Contract Drawings in sufficient detail or definition, submit detailed drawings of cast-in-place and precast concrete utility structures and related metal work.

C. Product Data: Submit manufacturers' product data for standard manufactured precast concrete utility boxes and structures and for metal gratings and covers and other, related miscellaneous metal items.

D. Certification: Submit certification or other acceptable evidence that covers and grates to be provided for roadways and parking areas meet proof-testing requirements for H2O and HS2O loadings in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

PART 2 – PRODUCTS

2.1 CAST-IN-PLACE CONCRETE STRUCTURES

A. Materials: Comply with requirements of Section 32 13 13 - Portland Cement Concrete, except as specified otherwise herein.

1. Portland Cement: ASTM C150, Type II, low alkali.

2. Cementitious Admixture: Provide fly ash or pozzolan conforming with ASTM C618, Class F or N, not to exceed 15 percent by weight of the cement content.

3. Aggregates: ASTM C33, fine aggregate and Size Nos. 56 or 57 (1-inch maximum size) coarse aggregate.

B. Mix Design: Obtain design of concrete mix as specified in Section 32 13 13 - Portland Cement Concrete, and incorporate the following requirements:

1. Concrete Strength: Class 4000 minimum in accordance with Table 03305-A of Section 32 13 13 - Portland Cement Concrete, except that electrical structures, such as vaults, pull boxes, and concrete for ductbanks, shall be Class 3000.

2. Maximum water-cement plus pozzolan ratio: 0.45.

3. Maximum slump: 4 inches.

2.2 PRECAST CONCRETE STRUCTURES

A. General: The Contractor may provide precast concrete structures that conform to the general configuration, capacities, and inverts indicated.

B. Fabrication Standards: Comply with requirements of ASTM C478, ASTM C789, ASTM C850, and ASTM C858, as applicable, and applicable manufacturers' standards.

C. Materials: Comply with requirements of Section 03 21 00 - Concrete Reinforcing, Section 32 13 13 - Portland Cement Concrete, except as specified otherwise herein. Provide fine and coarse aggregates conforming to ASTM C33, in size commensurate with structure and reinforcement clearances.

D. Portland Cement Concrete: Class 4000 minimum in accordance with Table 03305-A of Section 32 13 13 - Portland Cement Concrete. Concrete may be polymer or latex modified to achieve higher strengths and denser concrete. Concrete shall not deteriorate from chemical attack of sanitary waste.

1. Concrete for electrical utility structures shall be Class 3000.

E. Precast Covers: Precast covers shall have the utility identification, such as "PG&E Gas Valve," stamped into the cover.

F. Quality Control: In accordance with Section 01, the Contractor shall perform such inspections and tests as required to verify compliance with these Specifications.

2.3 METAL COVERS, GRATES, AND INLETS

A. Ferrous Castings:

1. Metal used in manufacture of castings shall conform to ASTM A48, Class 35B for Gray Iron, or ASTM A536, Grade 65-45-12 for Ductile Iron.

2. Castings shall be of uniform quality, free from blowholes, shrinkage, distortion or other defects. Castings shall be smooth and cleaned by shotblasting.

3. Minimum tensile strength shall be 35,000 psi.

4. Castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall have continuously machined bearing surfaces to prevent rocking and rattling.

5. Where castings will be subjected to loads of H2O or greater, as indicated, provide ductile iron castings.

B. Aluminum Castings: Where required to reduce weights of larger covers for ease of handling, such covers may be manufactured of aluminum castings conforming to ASTM B26/B26M, Alloy No. 713.0. Minimum tensile strength shall be 32,000 psi.

C. Manhole Covers: Provide cast, manufactured manhole covers and frames with heavy-duty solid cover (lid) or vented cover (lid) as indicated. Covers shall be embossed or engraved with nonslip diamond or square cross-hatched pattern. Provide covers with embossed or engraved word identification, as indicated or appropriate, for the enclosed or underground utility.

D. Grates:

1. Cast Ferrous Grates: Grates for area drains and catch basins shall be heavy-duty, bicycle safe inlet grates and frames of size and configuration indicated. Grates in roadways and parking areas shall withstand H20 loadings when proof-tested in accordance with Caltrans Bridge Design Specifications Manual, Section 3.

2. Bar-Type Steel Grates: Bar-type steel gratings will be permitted only in areas where vehicular traffic will not be encountered.

E. Curb and Gutter Inlets: Provide cast, manufactured curb inlet frame, grate, and curb box of size and configuration indicated. Curb and gutter inlets shall conform to the contour and profile of the concrete curb and gutter. Grates shall be heavy-duty and bicycle-safe and shall withstand H20.

F. Cast Iron Manhole Steps: Provide cast, manufactured manhole steps with cross-hatched treads and with anchor configuration appropriate for cast-in-place concrete or precast concrete as indicated. Provide steps for installation 12 inches on center in vertical alignment.

2.4 MISCELLANEOUS METAL

A. Requirements: Provide channel inserts, pulling eyes, ladders, and electrical grounding rods for electrical manholes and pull boxes as indicated.

B. Steel Materials: Standard structural sections, shapes, plates, bars, and rods, as indicated, conforming with ASTM A36/A36M. Bars conforming with ASTM 108 will be acceptable.

C. Anchors and Bolts: Bolts and studs, nuts, and washers shall be hot-dip galvanized in accordance with ASTM A153.

D. Ladders: Provide standard-manufactured or custom-fabricated steel ladders as required to meet the conditions indicated. Steel ladders shall be hot-dip galvanized after fabrication.

E. Grounding and Bonding Materials: Conform with UL 467 and the following requirements:

1. Grounding Rods: Medium carbon steel core, copper-clad by the molten weld casting process, 3/4-inch diameter by 10 feet long in size.

2. Bare Conductors: ASTM B3, No. 1/0 AWG, Class B stranded, annealed copper conductor.

F. Fabrication: Form and fabricate the work as indicated. Include anchors, fasteners, and accessories to anchor and secure the work in place.

G. Galvanizing: All ferrous metal items shall be galvanized after fabrication by the hot-dip process in accordance with ASTM A123. Weight of the zinc coating shall conform with the requirements specified under "Weight of Coating" in ASTM A123.

2.5 MORTAR

A. Cement mortar for the sealing of openings for pipe penetrations, for cementing of joints of component parts of precast structures, for providing of flow characteristics for the bottoms of drainage structures, and other features as indicated shall conform with the Texas Building

Code, Chapter 21, Type S (without lime), with a minimum compressive strength at 28 days of 1,800 psi.

B. Mortar shall comply with applicable requirements of ASTM C270, including measurement, mixing, proportioning, and water retention. Ten percent by volume of the cement content of the mortar shall be fly ash or pozzolanic material conforming with ASTM C618.

C. Use mortar within 90 minutes after mixing. Discard mortar that has been mixed longer or that has begun to set. Re-tempering of mortar will not be permitted.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Requirements: Construct manholes, junction chambers, catch basins, curb and gutter inlets, trench drains, culverts, headwalls, wingwalls, pull boxes, utility boxes and vaults, and related utility structures in connection with the installation of pipe, conduits, ductbanks, and utility trenches, as indicated.

B. Excavation and Backfill: Provide excavation, prepared subgrade and aggregate base, and backfill as specified in Section 31 00 00 - Earthwork, Section 33 05 28 - Trenching and Backfilling for Utilities, Section 32 11 17 - Aggregate Subbase Courses, and Section 32 11 23 - Aggregate Base Course, as indicated.

C. Cast-in-Place Concrete Structures: Provide formwork, steel reinforcement, and concrete in accordance with applicable requirements of Section 03 21 00 - Concrete Reinforcing, and Section 32 13 73.19 - Cast-In-Place Concrete.

D. Precast Concrete Structures: Install as indicated. Comply with applicable requirements of ASTM C891. Provide such appurtenances and installation accessories, including cement mortar and sealants, as required for a complete installation.

E. Metal Components: Install manhole covers, grates and frames, curb and gutter inlets, metal steps, ladders, channel inserts, pulling eyes, and electrical grounding rods as indicated and in accordance with the respective manufacturer's instructions. Covers and grates in roadways, parking areas, and concrete walks shall be installed flush with adjacent, abutting pavement.

3.2 FIELD QUALITY CONTROL

A. The Contractor shall perform slump tests and strength tests of cast-in-place structures in accordance with the requirements specified in Section 32 13 13 - Portland Cement Concrete.

B. Acceptance of cast-in-place structures will be in accordance with Section 32 13 13, Portland Cement Concrete.

END OF SECTION 33 05 16

SECTION 33 05 28 **TRENCHING AND BACKFILL FOR UTILITIES**

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Excavation, trenching, foundation, embedment, and backfill for installation of utilities, including manholes and other pipeline structures.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No additional payment will be made for trench excavation, embedment and backfill under this Section. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

2. When Project Manager directs Contractor to over excavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6-inches Over Excavation of Trench Bottom.

a. No payment will be paid if Project Manager does not direct Contractor to over excavate trench bottom.

b. No over excavation will be measured or paid when unsuitable conditions result from dewatering system not in conformance with Section 01.

3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost in unit price for installed underground piping, sewer, conduit, or duct work.

4. Refer to Section 01 for unit price procedures.

B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price

1.3 DEFINITIONS

A. Pipe Foundation: Suitable and stable native soils that are exposed at trench subgrade after excavation to depth of bottom of bedding as shown on Drawings, or foundation backfill material placed and compacted in over-excavations.

B. Pipe Bedding: Portion of trench backfill that extends vertically from top of foundation up to level line at bottom of pipe, and horizontally from one trench sidewall to opposite sidewall.

C. Haunching: Material placed on either side of pipe from top of bedding up to springline of pipe and horizontally from one trench sidewall to opposite sidewall.

D. Initial Backfill: Portion of trench backfill that extends vertically from springline of pipe (top of haunching) up to level line 12-inches above top of pipe, and horizontally from one trench sidewall to opposite sidewall.

E. Pipe Embedment: Portion of trench backfill that consists of bedding, haunching and initial backfill.

F. Trench Zone: Portion of trench backfill that extends vertically from top of pipe embedment up to pavement subgrade or up to final grade when not beneath pavement.

G. Unsuitable Material: Unsuitable soil materials are the following:

1. Materials that are classified as ML, CL-ML, MH, PT, OH, and OL according to ASTM D 2487.

2. Materials that cannot be compacted to required density due to gradation, plasticity, or moisture content.

3. Materials that contain large clods, aggregates, stones greater than 4-inches in any dimension, debris, vegetation, waste or any other deleterious materials.

4. Materials that are contaminated with hydrocarbons or other chemical contaminants.

H. Suitable Material: Suitable soil materials are those meeting specification requirements. Materials mixed with lime, fly ash, or cement that can be compacted to required density and meeting requirements for suitable materials may be considered suitable materials, unless otherwise indicated.

I. Backfill: Suitable material meeting specified quality requirements placed and compacted under controlled conditions.

J. Ground Water Control Systems: Installations external to trench, such as well points, reductors, or deep wells. Ground water control includes dewatering to lower ground water, intercepting seepage which would otherwise emerge from side or bottom of trench excavation, and depressurization to prevent failure or heaving of excavation bottom. Refer to Section 01.

K. Surface Water Control: Diversion and drainage of surface water runoff and rain water away from trench excavation. Rain water and surface water accidentally entering trench shall be controlled and removed as part of excavation drainage.

L. Excavation Drainage: Removal of surface and seepage water in trench by sump pumping and using drainage layer, as defined in ASTM D 2321, placed on foundation beneath pipe bedding or thickened bedding layer of Class I material.

M. Trench Conditions are defined with regard to stability of trench bottom and trench walls of pipe embedment zone. Maintain trench conditions that provide for effective placement and compaction of embedment material directly on or against undisturbed soils or foundation backfill, except where structural trench support is necessary.

1. Dry Stable Trench: Stable and substantially dry trench conditions exist in pipe embedment zone as result of typically dry soils or achieved by ground water control (dewatering or depressurization) for trenches extending below ground water level.

2. Stable Trench with Seepage: Stable trench in which ground water seepage is controlled by excavation drainage.

a. Stable Trench with Seepage in Clayey Soils: Excavation drainage is provided in lieu of or to supplement ground water control systems to control seepage and provide stable trench subgrade in predominately clayey soils prior to bedding placement.

b. Stable Wet Trench in Sandy Soils: Excavation drainage is provided in embedment zone in combination with ground water control in predominately sandy or silty soils.

3. Unstable Trench: Unstable trench conditions exist in pipe embedment zone if ground water inflow or high-water content causes soil disturbances, such as sloughing, sliding, boiling, heaving or loss of density.

N. Sub-trench: Sub-trench is special case of benched excavation. Sub-trench excavation below trench shields or shoring installations may be used to allow placement and compaction of foundation or embedment materials directly against undisturbed soils. Depth of sub-trench depends upon trench stability and safety as determined by Contractor.

O. Trench Dam: Placement of low permeability material in pipe embedment zone or foundation to prohibit ground water flow along trench.

P. Over-excavation and Backfill: Excavation of subgrade soils with unsatisfactory bearing capacity or composed of otherwise unsuitable materials below top of foundation as shown on Drawings and backfilled with foundation bedding.

Q. Foundation Bedding: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation bedding is placed and compacted as backfill to provide stable support for bedding. Foundation bedding materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Section 33 05 28 Trenching Backfill for Utilities. n

S. Trench Shield (Trench Box): Portable worker safety structure moved along trench as work proceeds, used as protective system and designed to withstand forces imposed on it by caving, thereby protecting persons within trench. Trench shields may be stacked if so designed or placed in series depending on depth and length of excavation to be protected.

T. Shoring System: Structure that supports sides of an excavation to maintain stable soil conditions and prevent cave-ins, or to prevent movement of ground affecting adjacent installations or improvements.

U. Special Shoring: Shoring system meeting special shoring as specified in Paragraph 1.08, Special Shoring Design Requirements, for locations identified on Drawings.

V. Vacuum Excavation: An excavation technique performed by an experienced subcontractor in which water or air jetting is used to slough off and vacuum away soil.

W. Large Diameter Water Line (LDWL): Water line that is 24-inches in diameter or larger. X. Emergency Action Plan (EAP): The EAP document should include a discussion of procedures for timely and reliable detection, classification (level of emergency) and response procedure to a potential emergency condition associated with a large diameter water line.

X. Subsurface Utility Exploration (SUE): Non-destructive excavation, unless otherwise approved

by project manager.

1.4 REFERENCES

A. ASTM A 798 – Standard Practice for Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications.

B. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipelines.

C. ASTM C 891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures

D. ASTM C 1479 - Standard Practice for Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

E. ASTM C 1675 - Standard Practice for Installation of Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers

F. ASTM C 1821 - Standard Practice for Installation of Underground Circular Precast Concrete Manhole Structures

G. ASTM D 558 - Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures.

H. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)).

I. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

J. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

K. ASTM D 2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classifications System).

L. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

M. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

N. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

O. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

P. TxDOT Tex-110-E - Particle Size Analysis of Soils.

Q. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA).

1.5 SCHEDULING

A. Schedule work so that pipe embedment can be completed on same day that acceptable foundation has been achieved for each section of pipe installation, manhole, or other structures.

B. For proposed utility adjacent to or across existing LDWL:

1. Conduct a meeting between contractor, Drinking Water Operations and Utility Maintenance Branch prior to beginning excavation to coordinate the EAP in the event a water line shut down becomes necessary.

2. Notify Drinking Water Operations a minimum of 1 week prior to beginning construction activities.

3. Notify Drinking Water Operations a minimum of 48 hours prior to beginning SUE work near LDWL.

4. Unless otherwise approved by City Engineer, perform construction activities between 7 AM and 7 PM, Monday through Friday. No work permitted around a LDWL on weekends or City Holiday.

5. A City Inspector must be present during SUE or construction activities occurring within four feet or one diameter of the LDWL, whichever is greater, from a LDWL or appurtenance.

1.6 SUBMITTALS

A. Conform to requirements of Section 01.

B. Submit planned typical method of excavation, backfill placement and compaction including:

1. Trench widths.

2. Procedures for foundation and pipe zone bedding placement, and trench backfill compaction.

3. Procedures for assuring compaction against undisturbed soil when pre-manufactured trench safety systems are proposed.

C. Submit backfill material sources and product quality information in accordance with requirements of Section 31 23 00 – Grading Excavation and Fill.

D. Submit trench excavation safety program in accordance with requirements of Section 02. Include designs for special shoring meeting requirements defined in Paragraph 1.08, Special Shoring Design Requirements contained herein.

E. Submit record of location of utilities as installed, referenced to survey control points. Include locations of utilities encountered or rerouted. Give stations, horizontal dimensions, elevations, inverts, and gradients.

F. Submit 11-inch by 17-inch or 12-inch by 18-inch copy of Drawing with plotted utility or obstruction location titled "Critical Location Report" to Project Manager.

G. For installation of proposed utility adjacent to or across existing LDWL, prepare and submit the following to Drinking Water Operations prior to beginning construction activities. Obtain approval from Drinking Water Operations prior to commencing prelocate or utility work near

LDWL.

1. Trench details, shoring system designs, installation sequences, and flowable fill mix designs.

2. Emergency Action Plan (EAP) to address contingency plans in the event of damage to or failure of LDWL. Include the following:

   a. Contact personnel and agencies including primary and secondary telephone numbers.

   b. Contractor’s hierarchy of responsible personnel.

   c. Traffic control measures.

   d. Identification of resources to be available on or near project site in event of damage to or failure of LDWL.

1.7 TESTS

A. Testing and analysis of backfill materials for soil classification and compaction during construction will be performed by an independent laboratory provided by City in accordance with requirements of Section 01 and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Section 312300 – Grading Excavation and Fill.

1.8 SPECIAL SHORING DESIGN REQUIREMENTS

A. Have special shoring designed or selected by Contractor's Professional Engineer to provide support for sides of excavations, including soils and hydrostatic ground water pressures as applicable, and to prevent ground movements affecting adjacent installations or improvements such as structures, pavements and utilities. Special shoring may be a premanufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Perform excavation with hydraulic excavator or other equipment suitable for achieving requirements of this Section.

B. Use only hand-operated tamping equipment until minimum cover of 12-inches is obtained over pipes, conduits, and ducts. Do not use heavy compacting equipment until adequate cover is attained to prevent damage to pipes, conduits, or ducts.

C. Use trench shields or other protective systems or shoring systems which are designed and operated to achieve placement and compaction of backfill directly against undisturbed native soil.

D. Use special shoring systems where required which may consist of braced sheeting, braced soldier piles and lagging, slide rail systems, or other systems meeting requirements as specified in Paragraph 1.08, Special Shoring Design Requirements.

2.2 MATERIAL CLASSIFICATIONS

A. Embedment and Trench Zone Backfill Materials: Conform to classifications and product descriptions of Section 31 23 00 – Grading Excavation and Fill and Section 02321 – Cement Stabilized Sand.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Section 33 05 16 - Utility Structures.

C. Geotextile (Filter Fabric): Conform to requirements of Section 02621 Geotextile.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

PART 3 – EXECUTION

3.01 STANDARD PRACTICE

A. Install flexible pipe, including "semi-rigid" pipe, to conform to standard practice described in ASTM D 2321, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

B. Install rigid pipe to conform to standard practice described in ASTM C 12, C 1479, or C 1675as applicable, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

3.02 PREPARATION

A. Establish traffic control to conform to requirements of Section 01. Maintain barricades and warning lights for streets and intersections affected by Work, and are considered hazardous to traffic movements.

B. Perform work to conform to applicable safety standards and regulations. Employ trench safety system as specified in Section 02.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Project Manager and agency for any repairs or relocations, either temporary or permanent.

D. Remove existing pavements and structures, including sidewalks and driveways, to conform to requirements of Section 02, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Section 01. Provide stable trench to allow installation in accordance with Specifications.

F. Maintain permanent benchmarks, monumentation, and other reference points. Unless otherwise directed in writing, replace those which are damaged or destroyed in accordance with Section 01.

3.03 CRITICAL LOCATION INVESTIGATION

A. Horizontal and vertical location of various underground lines shown on Drawings, including but not limited to water lines, gas lines, storm sewers, sanitary sewers, telecommunication lines, electric lines or power ducts, pipelines, concrete and debris,

are based on best information available but are only approximate locations. Unless otherwise approved by Project Manager, at Critical Locations shown on Drawings, perform vacuum excavation to field verify horizontal and vertical locations of such lines within a zone 2 feet vertically and 4 feet horizontally of proposed work exclude water jetting at PCCP water line.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate or prior to beginning installation of auger pit or tunnel shaft. Use extreme caution and care when uncovering utilities designated by Critical Locate.

2. Notify Project Manager in writing immediately upon identification of obstruction. In event of failure to identify obstruction in minimum of 7 days, Contractor will not be entitled to extra cost for downtime including, but not limited to, payroll, equipment, overhead, demobilization and remobilization, until 7 days has passed from time Project Manager is notified of obstruction.

B. Notify involved utility companies of date and time that investigation excavation will occur and request that their respective utility lines be marked in field. Comply with utility or pipeline company requirements that their representative be present during excavation. Provide Project Manager with 48 hours notice prior to field excavation or related work.

C. Survey vertical and horizontal locations of obstructions relative to project baseline and datum and plot on 12-inch by 18-inch copy of Drawings. For large diameter water lines, submit to Project Manager for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

D. LDWL Prelocate Requirements:

1. Field-locate LDWL, appurtenances and laterals connected directly to LDWL through use of non-probing method such as a vacuum truck (non-water jetting method) at no greater than 50-foot intervals. Locate upstream and downstream of proposed work or utility installation.

2. Record crown and side of LDWL adjacent to proposed work or utility installation. Record LDWL locations horizontally and vertically using same coordinate system employed on proposed utility drawings.

3. Tie horizontal and vertical coordinates into project baseline. Submit recordings performed by R.P.L.S to City a minimum of 14 days prior to mobilizing to site.

3.04 PROTECTION

A. Protect trees, shrubs, lawns, existing structures, and other permanent objects outside of grading limits and within grading limits as designated on Drawings, and in accordance with requirements of Section 01.

B. Protect and support above-grade and below-grade utilities which are to remain.

C. Restore damaged permanent facilities to pre-construction conditions unless replacement or abandonment of facilities is indicated on Drawings.

D. Take measures to minimize erosion of trenches. Do not allow water to pond in trenches. Where slides, washouts, settlements, or areas with loss of density or pavement

failures or potholes occur, repair, re-compact, and pave those areas at no additional cost to City.

E. Contingency plans for proposed work or utility installation adjacent to or across a LDWL:

1. Conduct on-site emergency drill prior to commencing proposed utility installation, and at three month intervals to assure EAP is current.

2. In the event a LDWL shut down becomes necessary, secure site and provide assistance to City personnel to access pipe and isolation valves as needed.

3.05 EXCAVATION

A. Except as otherwise specified or shown on Drawings, install underground utilities in open cut trenches with vertical sides.

B. Perform excavation work so that pipe, conduit, and ducts can be installed to depths and alignments shown on Drawings. Avoid disturbing surrounding ground and existing facilities and improvements.

C. Determine trench excavation widths using following schedule as related to pipe outside diameter (O.D.). Excavate trench so that pipe is centered in trench.

Nominal Pipe Size, Inches	Minimum Trench Width, Inches
Less than 18	O.D. + 18
18 to 30	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

D. Use sufficient trench width or benches above embedment zone for installation of well point headers or manifolds and pumps where depth of trench makes it uneconomical or impractical to pump from surface elevation. Provide sufficient space between shoring cross braces to permit equipment operations and handling of forms, pipe, embedment and backfill, and other materials.

E. Upon discovery of unknown utilities, badly deteriorated utilities not designated for removal, or concealed conditions, discontinue work at that location. Notify Project Manager and obtain instructions before proceeding.

F. Shoring of Trench Walls.

1. Install Special Shoring in advance of trench excavation or simultaneously with trench excavation, so that soils within full height of trench excavation walls will remain laterally supported at all times.

2. For all types of shoring, support trench walls in pipe embedment zone throughout installation. Provide trench wall supports sufficiently tight to prevent washing trench wall soil out from behind trench wall support.

3. Leave sheeting driven into or below pipe embedment zone in place to preclude

loss of support of foundation and embedment materials, unless otherwise directed by Project Manager. Leave rangers, walers, and braces in place as long as required to support sheeting, which has been cut off, and trench wall in vicinity of pipe zone.

4. Employ special methods for maintaining integrity of embedment or foundation material. Before moving supports, place and compact embedment to sufficient depths to provide protection of pipe and stability of trench walls. As supports are moved, finish placing and compacting embedment.

5. If sheeting or other shoring is used below top of pipe embedment zone, do not disturb pipe foundation and embedment materials by subsequent removal. Maximum thickness of removable sheeting extending into embedment zone shall be equivalent of 1-inch-thick steel plate. As sheeting is removed, fill in voids left with grouting material.

G. Use of Trench Shields. When trench shield (trench box) is used as worker safety device, the following requirements apply:

1. Make trench excavations of sufficient width to allow shield to be lifted or pulled freely, without damage to trench sidewalls.

2. Move trench shields so that pipe, and backfill materials, after placement and compaction, are not damaged nor disturbed, nor degree of compaction reduced. Re- compact after shield is moved if soil is disturbed.

3. When required, place, spread, and compact pipe foundation and bedding materials beneath shield. For backfill above bedding, lift shield as each layer of backfill is placed and spread. Place and compact backfill materials against undisturbed trench walls and foundation.

4. Maintain trench shield in position to allow sampling and testing to be performed in safe manner.

5. Conform to applicable Government regulations.

H. Voids under paving area outside shield caused by Contractor's work will require removal of pavement, consolidation and replacement of pavement in accordance with Contract Documents. Repair damage resulting from failure to provide adequate supports.

I. Place sand or soil behind shoring or trench shield to prevent soil outside shoring from collapsing and causing voids under pavement. Immediately pack suitable material in outside voids following excavation to avoid caving of trench walls.

J. Coordinate excavation within 15 feet of pipeline with company's representative. Support pipeline with methods agreed to by pipeline company's representative. Use small, rubber- tired excavator, such as backhoe, to do exploratory excavation. Bucket that is used to dig in close proximity to pipelines shall not have teeth or shall have guard installed over teeth to approximate bucket without teeth. Excavate by hand within 1 foot of Pipeline Company’s line. Do not use larger excavation equipment than normally used to dig trench in vicinity of pipeline until pipelines have been uncovered and fully exposed. Do not place large excavation and hauling equipment directly over pipelines unless approved by Pipeline Company’s representative.

K. When, during excavation to uncover pipeline company's pipelines, screwed collar or an oxy- acetylene weld is exposed, immediately notify Project Manager. Provide supports for collar or welds. Discuss with Pipeline Company's representative and determine methods of supporting collar or weld during excavation and later backfilling operations. When collar is exposed, request Pipeline Company to provide welder in a timely manner to weld ends of collar prior to backfilling of excavation.

L. Excavation and shoring requirements for proposed work or utility installation adjacent to or across a LDWL:

1. Identify LDWL area in field and barricade off from construction activities. Allow no construction related activities including, but not limited to, loading of dump trucks and material staging or storage, on top of LDWL.

2. Employ a groundwater control system when performing excavation activities within ten feet of LDWL to:

   a. Effectively reduce hydrostatic pressure affecting excavations,

   b. Develop substantially dry and stable subgrade for subsequent construction operations,

   c. Prevent loss of fines, seepage, boils, quick condition or softening of foundation strata, and

   d. Maintain stability of sides and bottom of excavations.

3. When edge of proposed trench or shoring is within a distance equal to one diameter of LDWL from outside of wall of LDWL, valve or appurtenance:

   a. Maintain minimum of four (4) feet horizontal clearance and minimum of two (2) feet vertical clearance between proposed utility and LDWL.

   b. Auger Construction

      1) Maintain minimum of four (4) feet horizontal clearance between proposed utility and LDWL.

      2) Dry auger method required when auger hole is 12-inches and larger in diameter.

   c. Open Cut Construction and Auger pits

      1) Perform hand excavation when within four (4) feet of LDWL.

      2) Employ hydraulic or pneumatic shoring system. Do not use vibratory or impact driven shoring or piling.

      3) Expose no more than 30-feet of trench prior to backfilling.

      4) A maximum of one (1) foot of vertical trench shall be un-braced at a time to maintain constant pressure on face

of excavated soil.

5) Upon removal of shoring system, inject flowable fill into void space left behind by shoring system. Comply with Standard Specification 02.

d. When edge of utility excavation is greater than one diameter of LDWL from outside wall of LDWL, use a shielding system as required by Project Manager and proposed utility standards and practices.

3.06 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Section 02. Place material suitable for backfilling in stockpiles at distance from trench to prevent slides or cave-ins.

B. When required, provide additional backfill material conforming to requirements of Section 02.

C. Do not place stockpiles of excess excavated materials on streets and adjacent properties. Protect backfill material to be used on site. Maintain site conditions in accordance with Section 01. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.07 TRENCH FOUNDATION

A. Excavate bottom of trench to uniform grade to achieve stable trench conditions and satisfactory compaction of foundation or bedding materials.

B. When wet soil is encountered on trench bottom and dewatering system is not required, over excavate an additional 6-inches with approval by Project Manager. Place non-woven geotextile fabric and then compact 12-inches of crushed stone in one lift on top of fabric. Compact crushed stone with four passes of vibratory-type compaction equipment.

C. Perform over excavation, when directed by Project Manager, in accordance with Paragraph 3.07.B above. Removal of unstable or unsuitable material may be required if approved by Project Manager;

1. Even though Contractor has not determined material to be unsuitable, or

2. If unstable trench bottom is encountered and an adequate ground water control system is installed and operating according to Section 01.

D. Place trench dams in Class I foundations in line segments longer than 100 feet between manholes and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.08 PIPE EMBEDMENT, PLACEMENT, AND COMPACTION

A. Remove loose, sloughing, caving, or otherwise unsuitable soil from bottoms and sidewalls of trenches immediately prior to placement of embedment materials.

B. Place embedment including bedding, haunching, and initial backfill as shown on Drawings.

C. For pipe installation, manually spread embedment materials around pipe to provide uniform bearing and side support when compacted. Protect flexible pipe from damage during placing of pipe zone bedding material. Perform placement and compaction directly against undisturbed soils in trench sidewalls, or against sheeting which is to remain in place.

D. Do not place trench shields or shoring within height of embedment zone unless means to maintain density of compacted embedment material are used. If moveable supports are used in embedment zone, lift supports incrementally to allow placement and compaction of material against undisturbed soil.

E. Place geotextile to prevent particle migration from in-situ soil into open-graded (Class I) embedment materials or drainage layers.

F. Do not damage coatings or wrappings of pipes during backfilling and compacting operations. When embedding coated or wrapped pipes, do not use crushed stone or other sharp, angular aggregates.

G. Place haunching material manually around pipe and compact it to provide uniform bearing and side support. If necessary, hold small-diameter or lightweight pipe in place during compaction of haunch areas and placement beside pipe with sand bags or other suitable means.

H. Place electrical conduit, if used, directly on foundation without bedding.

I. Shovel in-place and compact embedment material using pneumatic tampers in restricted areas, and vibratory-plate compactors or engine-powered jumping jacks in unrestricted areas. Compact each lift before proceeding with placement of next lift. Water tamping is not allowed.

J. For water lines construction embedment, use bank run sand, concrete sand, gem sand, pea gravel, or crushed limestone as specified in Section 02. Adhere to the following subparagraph numbers 1 and 2.

1. Class I, II and III Embedment Materials:

   a. Maximum 6-inches compacted lift thickness.

   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.

   c. Moisture content to be within -3 percent to +5 percent of optimum as determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement Stabilized Sand (where required for special installations):

   a. Maximum 6-inches compacted thickness.

   b. Compact to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698.

c. Moisture content to be on dry side of optimum as determined according to ASTM D 698 but sufficient for effective hydration.

K. For Sanitary Sewers adhere to subparagraph number 1 and 2. For Storm Sewers provide cement stabilized sand per paragraph 2. This provision does not apply to Storm Sewers constructed of HDPE pipe installed under pavement.

1. Class I Embedment Materials.

a. Maximum 6-inches compacted lift thickness.

b. Systematic compaction by at least two passes of vibrating equipment. Increase compaction effort as necessary to effectively embed pipe to meet deflection test criteria.

c. Moisture content as determined by Contractor for effective compaction without softening soil of trench bottom, foundation or trench walls.

2. Class II Embedment and Cement Stabilized Sand.

a. Maximum 6-inches compacted thickness.

b. Compaction by methods determined by Contractor to achieve minimum of 95 percent of maximum dry density as determined according to ASTM D 698 for Class II materials and according to ASTM D 558 for cement stabilized materials.

c. Moisture content of Class II materials within 3 percent of optimum as determined according to ASTM D 698. Moisture content of cement stabilized sands on dry side of optimum as determined according to ASTM D 558 but sufficient for effective hydration.

L. For Storm Sewers constructed of any flexible pipe product and installed under pavement provide flowable fill pipe embedment as specified in Section 02.

M. Place trench dams in Class I embedment in line segments longer than 100 feet between manholes, and not less than one in every 500 feet of pipe placed. Install additional dams as needed to achieve workable construction conditions. Do not place trench dams closer than 5 feet from manholes.

3.09 TRENCH ZONE BACKFILL PLACEMENT AND COMPACTION

A. Place backfill for pipe or conduits and restore surface as soon as practicable. Leave only minimum length of trench open as necessary for construction.

B. For water lines, under pavement and to within one foot back of curb, use backfill materials described below:

1. For water lines 20-inches in diameter and smaller, use bank run sand or select backfill materials up to pavement base or subgrade.

2. For water lines 24-inches in diameter and larger, backfill with suitable on-site

material (random backfill) up to 12-inches below pavement base or subgrade. Place minimum of 12-inches of select backfill below pavement base or subgrade.

C. For sewer pipes (Storm and Sanitary), use backfill materials described by trench limits. For "trench zone backfill" under pavement and to within one foot back of curb, use cement stabilized sand for pipes of nominal sizes 36-inches in diameter and smaller to level 12 inches below the pavement. For sewer pipes 42-inches in diameter and larger, under pavement or natural ground, backfill from 12-inches above top of pipe to 120 inches below pavement with suitable on-site material or select backfill. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12-inch backfill directly under pavement. For backfill materials reference Section 31 23 00- Grading Excavation and Fill. This provision does not apply where a Storm Sewer is constructed of any flexible pipe product.

D. For Storm Sewers constructed of any flexible pipe product and installed under pavement provide flowable fill as specified in Section 02. For Storm Sewers constructed of any flexible pipe product and not installed under pavement provide cement stabilized sand.

E. Where damage to completed pipe installation work is likely to result from withdrawal of sheeting, leave sheeting in place. Cut off sheeting 1.5-feet or more above crown of pipe Remove trench supports within 5-feet from ground surface.

F. Unless otherwise shown on Drawings. Use one of the following trench zone backfills under pavement and to within one foot of edge of pavement. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.

1. Class I, II, or III or combination thereof:

   a. Place in maximum 12-inch thick loose layers.

   b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

   c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless otherwise approved by Project Manager.

2. Cement-Stabilized Sand:

   a. Maximum lift thickness determined by Contractor to achieve uniform placement and required compaction, but do not exceed 12-inches.

   b. Compact by vibratory equipment to minimum of 95 percent of maximum dry density determined according to ASTM D 558.

   c. Moisture content on dry side of optimum determined according to ASTM D 558 but sufficient for cement hydration.

3. Class IVA and IVB (Clay Soils):

   a. Place in maximum 8-inch thick loose lifts.

b. Compaction by vibratory Sheepfoot roller to minimum of 95 percent of maximum dry density determined according to ASTM D 698.

c. Moisture content within zero percent to 5 percent above optimum determined according to ASTM D 698, unless approved by Project Manager.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone. This provision does not apply to flexible pipe used for storm sewers.

1. Fat clays (CH) may be used as trench zone backfill outside paved areas at Contractor's option. When required density is not achieved, at any additional cost to City, rework, dry out, use lime stabilization or other approved methods to achieve compaction requirements, or use different suitable material.

2. Maximum 9-inch compacted lift thickness for clayey soils and maximum 12-inch lift thickness for granular soils.

3. Compact to minimum of 90 percent of maximum dry density determined according to ASTM D 698.

4. Moisture content as necessary to achieve density.

H. For electric conduits, remove form work used for construction of conduits before placing trench zone backfill.

3.10 MANHOLES, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Below paved areas or where shown on Drawings, encapsulate manhole with cement stabilized sand; minimum of 2 foot below base, minimum 2 foot around walls, up to pavement subgrade or natural ground. Compact in accordance with Paragraph 3.09.F.2 of this Section

B. In unpaved areas, use select fill for backfill. Existing material that qualifies as select material may be used, unless indicated otherwise on Drawings. Deposit backfill in uniform layers and compact each layer as specified. Maintain backfill material at no less than 2 percent below nor more than 5 percent above optimum moisture content, unless otherwise approved by Project Manager. Place fill material in uniform 8-inch maximum loose layers. Compact fill to at least 95 percent of maximum Standard Proctor Density according to ASTM D 698.

C. For LDWL projects, encapsulate manhole with cement stabilized sand; minimum of 1 foot below base, minimum of 2 feet around walls, up to within 12-inches of pavement subgrade or natural ground. For manholes over water line, extend encapsulation to bottom of trench. Compact in accordance with Paragraph 3.09 F.2 of this Section.

3.11 FIELD QUALITY CONTROL

A. Test for material source qualifications as defined in Section 02320 - Utility Backfill Materials.

B. Provide excavation and trench safety systems at locations and to depths required for

testing and retesting during construction at no additional cost to City.

C. Tests will be performed on minimum of three different samples of each material type for plasticity characteristics, in accordance with ASTM D 4318, and for gradation characteristics, in accordance with Tex-101-E and Tex-110-E. Additional classification tests will be performed whenever there is noticeable change in material gradation or plasticity, or when requested by Project Manager.

D. At least three tests for moisture-density relationships will be performed initially for backfill materials in accordance with ASTM D 698, and for cement- stabilized sand in accordance with ASTM D 558. Perform additional moisture-density relationship tests once a month or whenever there is noticeable change in material gradation or plasticity.

E. In-place density tests of compacted pipe foundation, embedment and trench zone backfill soil materials will be performed according to ASTM D 1556, or ASTM D 2922 and ASTM D 3017, and at following frequencies and conditions.

1. For open cut construction projects and auger pits: Unless otherwise approved by Project Manager, successful compaction to be measured by one test per 40 linear feet measured along pipe for compacted embedment and two tests per 40 linear feet measured along pipe for compacted trench zone backfill material. Length of auger pits to be measured to arrive at 40 linear feet.

2. A minimum of three density tests for each full shift of Work.

3. Density tests will be distributed among placement areas. Placement areas are: foundation, outer bedding, haunching, initial backfill and trench zone.

4. The number of tests will be increased if inspection determines that soil type or moisture content are not uniform or if compacting effort is variable and not considered sufficient to attain uniform density, as specified.

5. Density tests may be performed at various depths below fill surface by pit excavation. Material in previously placed lifts may therefore be subject to acceptance/rejection.

6. Two verification tests will be performed adjacent to in-place tests showing density less than acceptance criteria. Placement will be rejected unless both verification tests show acceptable results.

7. Recompacted placement will be retested at same frequency as first test series, including verification tests.

8. Identify elevation of test with respect to natural ground or pavement.

F. Recondition, re-compact, and retest at Contractor's expense if tests indicate Work does not meet specified compaction requirements. For hardened soil cement with nonconforming density, core and test for compressive strength at Contractor's expense.

G. Acceptability of crushed rock compaction will be determined by inspection.

3.12 DISPOSAL OF EXCESS MATERIAL

A. Dispose of excess materials in accordance with requirements of Section 01.

END OF SECTION 33 05 28

SECTION 33 11 00 WATER DISTRIBUTION SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Buried pipe and fitting.

B. Valves.

C. Fire hydrants.

D. Thrust blocks and harnessing.

E. Field quality control.

F. Test.

G. System disinfection.

H. Connections to existing mains.

1.2 RELATED SECTIONS

A. Trenching, bedding, and backfilling for pipelines are specified in Section 33 05 28 - Trenching and Backfilling for Utilities.

B. Coordinate the work of this Section with the work of Section 33 11 33 – Water Lines.

1.3 MEASUREMENT AND PAYMENT

A. General: Measurement and payment for the water distribution system will be either by the lump- sum method or by the unit-price method as determined by the listing of the bid item for the water distribution system indicated in the Bid Schedule of the Bid Form.

B. Lump sum: If the Bid Schedule indicates a lump sum for the water distribution system, the lump- sum method of measurement and payment will be in accordance with Division 1 Specifications.

C. Unit price: If the Bid Schedule indicates a unit price for the water distribution system, the unit-price method of measurement and payment will be as follows:

1. Measurement:

a. Water distribution system will be measured for payment by the linear foot of pipe, installed in place, tested and disinfected, for each type and size of pipe, along the centerline of the pipe with deductions made for manholes or other structures, measured from the inside face of each structure.

b. Utility structures will be measured separately for payment as specified in Section 33 05 16, Utility Structures.

c. Pipe fittings, valves, joints, pipe bedding, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection therewith will be considered as included in the linear foot measurement for pipe.

d. Fire hydrants will be measured for payment by the individual unit (each), installed in place and acceptably tested.

e. Support of trench excavation, maintenance, support of existing utility facilities, grading, excavation and backfill, cast-in-place concrete, and incidental work pertaining to the installation of pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for pipe.

2. Payment: The water distribution system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.03.C.1.

1.4 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A126 Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

2. ASTM A197 Specification for Cupola Malleable Iron

3. ASTM A307 Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

4. ASTM D1784 Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

5. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

6. ASTM D2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40

7. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

8. ASTM D2855 Practice for Making Solvent-Cemented Joints, with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

9. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

10. ASTM F439 Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

11. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

B. American Water Works Association (AWWA):

1. AWWA C500 Gate Valve, 3 through 48 inches NPS – for Water and Sewage System
2. AWWA C503 Standard for Wet-Barrel Fire Hydrants
3. AWWA C504 Rubber Seated Butterfly Valve
4. AWWA C508 Swing-Check Valves for Water Works Service, 2 inches through 24 inches NPS
5. AWWA C606 Grooved and Shouldered Type Joints
6. ANSI/AWWA Standard for Disinfecting Water Mains C651
7. ANSI/AWWA Specification for Polyvinyl Chloride (PVC) Pressure Pipe, C900 4 in. through 12 in. for Water Distribution

C. Water Utility District Standards: Note that all work shall be performed and completed in accordance with the jurisdictional water utility district's standard drawings and specifications. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.

D. Underwriters Laboratories Inc. (UL):

1. UL 246 Hydrant for Fire-Protection Service

1.5 SUBMITTALS

A. Refer to Division 1 specifications for submittal requirements and procedures.

B. Submit respective manufacturer's product data for manufactured materials and equipment, including all valves and fire hydrants.

C. Submit Shop Drawings showing piping layout and pipe, valves, hydrants, and locations of tie-ins, buttresses, and thrust blocks.

1.6 SUBMITTALS FOR CLOSEOUT

A. General: Refer to Division 1 specifications for submittal requirements and procedures.

B. Record Drawings: Record actual location of piping mains, valves, connections, and invert elevations for review.

1.7 SITE CONDITIONS

A. Excavations in which products will be buried shall be dry.

B. Coordinate the installation of the water supply system with the jurisdictional water utility owner.

C. The jurisdictional water utility district shall provide water services to the water meters' points of connection for station facilities and landscape irrigation systems, and modifications to existing water mains, as indicated on the Contract Drawings. The Contractor shall be responsible for making all such arrangements.

PART 2 – PRODUCTS

2.1 BURIED PIPE AND FITTINGS

A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated.

B. PVC Pipe and Fittings, 3 Inches and Smaller:

1. Pipe: Polyvinyl chloride (PVC), ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1.

2. Fittings: ASTM D2466, socket weld, same material and schedule as pipe, or meeting requirements of ASTM F439, as applicable.

3. Joints: Socket welded with PVC solvent cement conforming to ASTM D2564 and ASTM D2855.

C. PVC Pipe and Fittings, 4 Inches and Larger:

1. Pipe: AWWA C900, Class 200, polyvinyl chloride (PVC) water pipe with bell and spigot ends and flexible ring joints.

2. Fittings: ASTM D1784, Type 1, Grade 1, polyvinyl chloride (PVC) fittings, Class 200, or meeting requirements of ASTM F439, as applicable.

3. Joints: ASTM D3139, gasketed bell joints with ASTM F477 gaskets.

2.2 VALVES

A. Gate Valves:

1. Gate Valves up to 2-1/2 Inches: 150-pound bronze body, non-rising stem, single wedge, threaded connection.

2. Gate Valve 3 Inches and Over: AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, mechanical joint ends with type gland and serration’s designed for plastic pipe service.

B. Pressure Reducing Valves: All bronze construction, spring-loaded, single-seated, suitable for tight shutoff under dead-end conditions. Provide with renewable composition seat discs, nylon inserted diaphragm, bolted spring chamber, and threaded connection.

C. Backflow Preventer: Provide a device that is approved by the jurisdictional water utility company. As a minimum, the backflow preventer shall be a reduced pressure principle assembly with two rising- stem gate shut-off valves, two resilient seat ball-valve test cocks, two check valves replaceable resilient disks and seat with relief valve with replaceable seat. Backflow preventer shall be suitable for 175 psig operating pressure and 140 degrees F operating temperature, and shall be of bronze construction with bronze internal parts and stainless steel springs, screwed

inlet and outlet for 2-inch and smaller sizes, and cast iron, epoxy- coated construction with 150 pound flanged inlet and outlet for 3-inch and largersizes.

2.3 FIRE HYDRANTS

A. Provide fire hydrants and related appurtenances as indicated. Fire hydrants shall comply with the requirements of the jurisdictional authority and the standard drawings and specifications of the jurisdictional water utility district, as applicable.

B. Fire hydrants shall meet the requirements of AWWA C502 and UL 246, as applicable, and shall be wet barrel type, as a minimum, with a minimum of two discharge nozzles of size(s) required by the jurisdictional authority.

2.4 CONCRETE FOR THRUST BLOCKS

A. Provide Class 3000, 1-inch aggregate, concrete for all thrust blocks with reinforcement where indicated.

2.5 MISCELLANEOUS METAL

A. Tie Rods: Stainless steel, Type 316, threaded ANSI standard, bolt threaded on both ends. Minimum 1/2-inch diameter for 4-inch pipe, 5/8-inch minimum diameter for 6-inch and 8-inch diameter pipe, and 3/4-inch minimum diameter for 12-inch and larger.

B. Rod Couplings: Malleable iron, ASTM A197, turnbuckle design, female threaded to mate with tie rods, 5/8-inch and 3/4-inch sizes to mate with both rods and mechanical joint bolts.

C. Pipe Clamps: For sizes 4 inches and larger, provide with malleable iron rod sockets. Provide washers in lieu of rod sockets where authorized, conforming with ASTM A126, Class A, cast iron. Bolts and bolting shall conform with ASTMA307.

PART 3 - EXECUTION

3.1 MAINTAINING WATER SERVICES

A. Maintain water service and conduct operations at times selected to minimize the duration and inconvenience of service interruption.

B. At least 24 hours prior to the required cutting or abandoning of an existing water main, notify the jurisdictional water utility owner, and obtain approval of the schedule. Actual cutting or abandoning of an existing water main shall be performed by the Contractor after receiving approval from the owner of the facility.

C. Keep existing water mains parallel to new water mains in service until new water mains are ready for service.

D. Where the existing water main or service is to be cut for connection to new piping, the work shall be performed by the Contractor. Initial work operations shall include the test-pitting of all points of connection (tie-in) to ensure the true location of existing linework.

E. Water valves in service shall be operated only by personnel of the jurisdictional water utility owner.

F. Except as specified otherwise herein, construction methods shall be in accordance with the applicable provisions of the jurisdictional water utility owner's standard drawings and

specifications.

3.2 INSTALLATION

A. Installation Requirements:

1. Excavate pipe trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities. Hand trim bottom of trench to approximately 6 inches below invert of pipe.

2. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.

3. Place sand bedding material, meeting the requirements of Section 33 05 28 - Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.

4. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.

5. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities.

6. Maintain optimum moisture content of bedding material to attain required compaction density.

7. Provide concrete thrust blocks for elbows, tees, valves, and appurtenances of buried piping. Thrust blocks shall be constructed as indicated and in accordance with AWWA requirements.

8. Install piping true to line and grade, supported and guided to assure alignment under all conditions.

9. Install pipe to allow for expansion and contraction without stressing pipe or joints.

10. Install unions at each connection to valves, both sides of each valve.

11. Make change in line with fittings. Do not spring joints to effect change of direction.

12. Do not field cut pipe unless necessary. Make such necessary cuts by means of equipment designed for the purpose, ensuring a smooth and square end.

13. For connection to existing pipe, provide pipe with suitable ends or adapters, after verification of size and type of existing pipe.

14. Install tie rods and pipe clamps at every joint fitting and valve.

B. Valves:

1. Install valves in accordance with the valve manufacturer's installation instructions.

2. Where valves are provided by the jurisdictional water utility owner, provide suitable access for performance of such work.

3. Where necessary, alter the typical valve manhole to suit actual conditions. Any

alterations in valve manholes shall be operable from the street level. All operator nuts shall be plumb to the valve manholes.

4. Set valve on solid bearing.

5. Center and plumb valve box over valve. Set box cover flush with finished grade.

C. Fire Hydrants:

1. Provide fire hydrant installations as indicated. Installation shall conform with requirements of the jurisdictional fire department and the water utility owner's standard drawings and specifications.

2. Provide necessary appurtenances and accessories as required to complete the installation.

3. Paint hydrants in accordance with applicable City requirements.

4. Set hydrants plumb, locate pumper nozzle perpendicular to and facing roadway.

D. Thrust Blocks and Harnessing:

1. Provide for counteracting thrust caused by static and dynamic forces, including water hammer at bends, tees, reducers, valves, and dead ends by installing harnessing as indicated or required. For other methods, submit details for approval of the jurisdictional water utility owner prior to use.

2. Provide concrete thrust blocks as indicated where harnessing is not practicable.

E. Water Service Connections:

1. Provide water service connections, where necessary, in accordance with the Texas Plumbing Code, the installation instructions of the service pipe and fittings manufacturer, and the utility company requirements with reduced pressure back-flow preventer and water meter with by-pass valves.

F. Acceptance Requirements:

1. After installation of pipes, ends of pipes shall be either capped or plugged. No piping shall be buried before being inspected and tested.

3.3 FIELD QUALITY CONTROL

A. Refer to Division 1 Specifications for requirements.

B. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00 - Earthwork.

C. If tests indicate work does not meet specified requirements, remove such work, replace, and retest at no additional cost to the District.

3.4 TESTS

A. Protection from Flooding: Provide positive measures to protect exposed, installed pipe

and compacted pipe bedding from flooding during testing.

B. Notice of Testing:

1. Give 48 hours' notice of intention of testing to the jurisdictional water utility owner, which will furnish, install, and operate pumps, gages, meters, and individual pipe connections to test openings.

2. Designate largest sections feasible for testing and sterilizing. Testing and sterilizing operations shall be performed by the Contractor, at Contractor's expense.

C. Testing Requirements:

1. General:

a. Prior to backfilling, isolate the system by use of approved valves, caps and plugs, or other acceptable methods.

b. Maintain such isolation throughout the performance of leakage and pressure testing.

c. Where valves are used for isolation, eliminate leakage through such valves if it occurs. Maintain new work isolated from existing water mains, except for test connections, until testing and sterilization have been completed.

2. Hydrostatic Tests:

a. For hydrostatic tests, provide approved caps and plugs in sections to be tested, and remove them after testing.

b. Prevent leakage in pipes and fittings at openings. Temporarily block plugged and capped ends to prevent displacement.

c. Install the water source connection for testing the isolated section. The Engineer may permit the use of a tap that will be furnished and installed by utility owner.

d. Provide labor and materials required for leakage testing, including excavation for installation and removal of pumps, gages, meters, and water source connections.

e. Where leakage exceeds the water utility company's standards, perform necessary corrective measures.

f. Remove and replace defective pipes, joints, fittings, valves, and other appurtenances. Reset such items if displaced.

g. Perform hydrostatic tests in accordance with the jurisdictional water utility district's requirements. All such tests shall be witnessed by the jurisdictional water utility district's representative. The Contractor shall be responsible for making all such arrangements.

h. Remove and replace defective pipe, joints, fittings, valves, and other appurtenances. Reset such items if displaced.

D. Testing and Flushing of Potable Water System: Test the potable water system hydrostatically in sections to a pressure of at least 150 psi for not less than 15

minutes, witnessed by the Engineer. Pressure test pipe before burial. Repair leaks and retest the system until the system is leak free. Use testing instruments calibrated by a qualified laboratory in accordance with Division 1 Specifications. Test sequence shall be as follows:

1. Lines shall be fully flushed.

2. Lines shall be hydrostatically tested.

3. Lines shall be fully flushed.

4. Lines shall be fully disinfected.

3.5 SYSTEM DISINFECTION

A. Before final acceptance of the water supply system, each section of the new line shall be disinfected in accordance with ANSI/AWWA C651. One of the following sources of disinfectant shall be used:

1. Mixture of water and chlorine gas.

2. Direct application of chlorine.

3. Mixture of water and calcium hypochlorite; or

4. Mixture of water and calcium chloride.

B. Before disinfecting, flush the line thoroughly to remove dirt and extraneous materials. Clean each section of the line between valves independently.

C. Retain the disinfectant solution in the pipe for at least 24 hours. Following this sterilization period, the residual chlorine content at the ends of the section and at other representative points shall be not less than five parts per million. Then, the line shall be drained and thoroughly flushed with water until the residual chlorine content is similar to that obtained from the existing water distribution system.

D. Take water samples and test in accordance with ANSI/AWWA C651.

3.6 CONNECTIONS TO EXISTING MAINS

A. Following testing and sterilization, new water distribution lines shall be connected to existing mains as indicated. Each connection shall be made at a time and in a manner that will result in the least interruption of service.

B. All connections involving shut down of jurisdictional water utility's existing facilities shall be made under the immediate supervision of the jurisdictional water utility district. No member of the Contractor's forces may operate any valve controlling the flow of water in the water utility's existing system.

C. The Contractor shall provide tie-ins to the existing system at a time that is convenient to jurisdictional water utility district, which may be in the evenings and on weekends.

END OF SECTION 33 11 00

SECTION 33 16 53 **TRAFFIC PAINT STRIPING**

PART 1 - REFLECTORIZED MULTIPOLYMER PAVEMENT MARKINGS

1. DESCRIPTION.

This Item shall govern to furnish, and place reflectorized multi-polymer pavement markings as shown on the plans.

2. MATERIALS.

A. **Multi-Polymer Pavement Marking Materials.** Provide a prequalified multi-polymer resin material which is:

- toxic heavy metal free (lead, chromium, cadmium, and other toxic heavy metals as defined by the United States Environmental Protection Agency,)
- two-component (a predominantly multi-polymer pigmented resin component with a curing agent component),
- 100% solids, producing no toxic fumes when heated to application temperature,
- track-free in less than 40 minutes, and
- formulated and tested to perform as a pavement marking material with glass spheres applied to the surface.

Furnish in accordance with the requirements below.

Table 1
Color Requirements

Federal 595 Color		Chromaticity Coordinates								Brightness (Y)
		1		2		3		4		
		x	y	x	y	x	y	x	y	
White	17855	.290	.315	.310	.295	.350	.340	.330	.360	60 min
Yellow	33538	.470	.455	.510	.489	.490	.432	.537	.462	30 min

Table 2
Physical Properties

Property	Test Procedure	Min	Max
Abrasion Resistance, loss, 750±38µm film, 72 hr cure, CS17 wheel, 1000 g, 1000 cycles	ASTM C501		0.080 g
Hardness, Shore D	ASTM D 2240	75	
Adhesion, 375±38 µm film, 72 hr cure, 25C	ACI 503, Appendix A.1	Fail in Concrete	
Yellowness Index (White only), QUV, 375±38 µm film, 72 hr cure	ASTM 1925		30

Prequalify materials with the Construction Division, Materials and Pavements Section. To prequalify, supply:

- a test report showing proposed multi-polymer pavement marking materials meet the requirements above,
- a 1-quart sample of each component for specification verification, and
- documentation of acceptable performance from TxDOT pavement marking field applications that have been in place for at least 1 year or published documentation from the National Transportation Product Evaluation Program showing a minimum retro reflectivity readings along the skip lines of 250 mcd for white and 200mcd for yellow after one year.

Formulation changes require a new prequalification.
The material supplied to the project will be tested against the prequalification sample to assure that no formulation changes are made without notifying the Construction Division. The testing to characterize the project samples will include but not be limited by those requirements listed in Table 3. Tests to be run and allowable variations are:

Table 3 Material Requirements

Tests	Requirements
Density (Gallon Weight)	±0.10 lb./gal
Viscosity (Krebs-Stormer)	±7 KU
Viscosity (Cone & Plate)	±0.5 Poises
Grind	Not Less than the Standard
% Non-Volatile Matter	±1.0%
% Pigment (white)	±3.0 %
% Volume Non-Volatile Matter	±3.0%
Infrared Spectrum	Match Standard

Provide certified test results for project materials prior to the start of the project.

B. **Glass Traffic Beads.** Furnish Type II or Type III drop-on glass beads conforming to DMS-8290, “Glass Traffic Beads.” Use Type II beads only as a part of a double drop system with Type III beads. For double drop systems, dispense each type bead with a separate dispenser system, with the ratio of Type II beads not greater than 50% by weight of the beads used.

C. **Labeling.** Use clearly marked containers that indicate color, mass, material type, manufacturer, and batch number.

3. EQUIPMENT.

A. **General Requirements.** Use equipment which:
- is maintained in satisfactory condition,
- meets or exceeds the requirements of the National Board of Fire Underwriters and Texas Railroad Commission for this application,
- uses an automatic bead dispenser attached to the pavement marking equipment, and
- can provide continuous mixing and agitation of the pavement marking material.

B. **Material Placement Requirements.** Use equipment which can place:
- at least 40,000 ft. of 4-in. solid or broken markings per day at the specified thickness.
- linear markings up to 8 in. wide in a single pass.
- markings other than solid or broken lines.

- a center-line and no-passing barrier-line configuration consisting of 1 broken line with 2 solid lines, at the same time, to the alignment, spacing, and thickness shown on the plans, for 3- line application;
- white line from both sides;
- lines with clean edges, uniform cross-section and thickness and reasonably square ends;
- skip lines between 10 and 10-1/2 ft., an approximate stripe-to-gap ratio of 1 to 3, and a stripe–gap cycle between 39-1/2 ft. and 40-1/2 ft., automatically;
- beads uniformly and almost instantly upon the marking as the marking is being applied;
- beads uniformly during the application of 2 adjacent lines. Each line must have an equivalent bead yield rate and embedment;
- each component within the component mix tolerances recommended by the manufacturer.

4. CONSTRUCTION. Place markings prior to opening to traffic unless short term or work zone markings are allowed.

(1) **General.** Obtain approval for the sequence of work and estimated daily production. On roadways already open to traffic, place markings with minimum interference to the operations of that roadway. Use traffic control as shown on the plans or as approved. Protect all markings placed under open-traffic conditions from traffic damage and disfigurement.

Establish guides to mark the lateral location of pavement markings as shown on the plans or as directed and have guide locations verified. Use material for guides that will not leave a permanent mark on the roadway.
Apply markings on pavement that is completely dry and meets all temperature and humidity requirements of the manufacturer: Apply markings:

- using widths, colors, and at locations shown on the plans;
- in proper alignment with the guides without deviating from the alignment more than 1 in. per 200 ft. of roadway or more than 2 in. maximum;
- free of blisters and with no more than 5%, by area, holes or voids;
- with uniform cross section and thickness;
- with clean and reasonably square ends;
- which harden properly with no tackiness;
- using personnel skilled and experienced with installation of pavement markings;
- which are reflectorized; and
- that meet requirements in Test Method Tex-828-B.

Remove all applied markings that are not in alignment or sequence as stated in the plans or as stated in the specifications at the Contractor's expense in accordance with Item 677, "Eliminating Existing Pavement Markings and Markers," except for measurement and payment.

(2) Surface Preparation.

(a) Surface preparation methods should be determined by the manufacturer and be in accordance to Item 678.

(b) Cleaning for Asphalt Surfaces Younger Than 3 Years, Old Hydraulic Concrete Surfaces and All Retracing. Air-blast or broom old hydraulic cement concrete surfaces and all asphalt surfaces to remove loose material, unless otherwise shown on the plans.

(c) Cleaning for Asphalt Surfaces Older than 3 Years and New Hydraulic Concrete (No Existing Markings). Clean in accordance with Item 678, "Pavement Surface Preparation for Markings," to remove curing membrane, dirt, grease, loose and flaking existing construction markings, and other forms of contamination.

(3) **Application.** Apply markings during good weather unless otherwise directed. If markings are placed at Contractor option when inclement weather is impending and the markings are damaged by subsequent precipitation, the Contractor is responsible for all costs associated with replacing the markings if required.

Adding thinner to the coating is not allowed.
Apply on surfaces with a minimum surface temperature of 50ºF.

(4) **Performance Requirements.** All markings and replacement markings must meet the requirements of this Item for at least 15 calendar days after installation. Remove pavement markings that fail to meet requirements and replace at the Contractor's expense unless otherwise directed. Replace all failing markings within 30 days of notification.

If the material does not cure properly, remains soft and tacky, or discolors and the Engineer requires removal, at least 90% of the material must be removed by approved methods before restriping will be allowed.

Conduct visual inspections and instrument evaluations of placed pavement markings.

(a) **Visual Inspections.** Conduct a visual inspection of the stripe placement according to Tex-828-B, "Determining Functional Characteristics of Pavement Markings." Conduct reviews during dry off-peak traffic periods without closing any lanes. Conduct the inspection within 7 days after the stripe has been placed. A department's designated representative will be present for the inspection.

(b) **Instrument Evaluations.** Conduct instrument evaluations in areas as directed by the Engineer. For edge line markings; center-line/no passing barrier-line; and lane lines; meet the following initial minimum retro reflectivity values when measured between 5 and 15 days after application:

White markings: 250 millicandelas per square meter per lux (mcd/m^2lux)

Yellow markings: 200 mcd/m^2lux
Make all measurements in the direction of traffic flow, except for broken centerline on two-way roadways, where measurements will be made in both directions.

Provide a portable retro reflectometer, which uses 30-meter geometry meeting the requirements described in ASTM E 1710.

Provide a report to the Engineer of all readings taken and their approximate locations.

The Contractor is responsible for traffic control when making initial retroreflectivity measurements.

At locations approved by the Engineer, take a minimum of 1 measurement every mile on each series of markings (i.e. edge-line, center skip line, each line of a double line…etc.). If more than one measurement is taken, the measurements will be averaged. For all markings measured in both directions, take a minimum of 1 measurement in each direction.

If the measurement taken on a specific series of markings within each mile segment falls below the initial minimum retroreflectivity values, take a minimum of 5 more measurements within that mile segment for that series of marking. If the average of these 5 measurements falls below the initial minimum retroreflectivity requirements, that mile segment of the applied markings is considered unacceptable. Restripe any unacceptable segments until initial minimum retroreflectivity requirements are met.

(5) Warranty. Before application of pavement markings, provide TxDOT a warranty by the Manufacturer that the Manufacturer will replace, at no cost to the department, except as noted below, any materials which fail to meet the *warranty* performance requirements as listed in this specification for 3 years from the date the portion of the facility containing those markings becomes operational.

If the markings fail to meet the requirements of Special Specification 1653, the manufacturer will provide the replacement materials and labor that will restore the pavement marking retroreflectivity values to warranty levels or greater.

(a) **Warranty Performance Requirements.** Pavement markings will meet the following performance requirements for the warranted life of the materials.
Reflectivity. When measured at 30-meter geometry, maintain a minimum retroreflectivity value of:

- White markings: 150 mcd/m^2lux.
- Yellow markings: 125 mcd/m^2lux.

Durability. Pavement markings will maintain the color (daytime and nighttime reflected), length, width, shape, and configuration shown on the plans. Nighttime and daytime color will be essentially the same color as the standard maintained by the department's Construction Division, Materials Section.
Deviations in length, width, shape, or configuration caused by, in the Engineer's opinion, pavement failure will not be considered as a failure of the pavement markings.

(b) **Reflectivity Determination.** The following procedures will be used to determine the performance of pavement markings for warranty purposes. Periodic visual night inspection will be made by TxDOT as described by TxDOT Test Method TEX-828-B, when deemed necessary by the Engineer. The Manufacturer's representative may accompany the Engineer on a subsequent inspection when pavement markings do not appear to meet minimum retroreflectivity or nighttime color requirements. All retroreflectivity measurements shall be made on a clean, dry surface at a minimum temperature of 40°F. The average retroreflectivity value for the Measurement Zone shall be used to determine if the minimum performance values have been met.

Longitudinal Markings. A Measurement Zone shall consist of either edge lines, center lines, or lane lines, but not in combination. Random sampling techniques shall be used to determine the average reflectivity throughout the zone.

(c) **Replacement.** Pavement markings that do not meet the *warranty* performance requirements will be replaced by the Manufacturer normally within 15 days unless weather conditions or other conditions as approved by the Engineer dictate otherwise, but not more than 90 days. Notification will be by mail, return receipt requested, to an address as specified by the Manufacturer as indicated on the warranty.

The Manufacturer will be responsible for application, at no cost to the department, of all replacement materials covered by the warranty.

(d) **Exclusions.** Up to 5% of the markings on any project may at the discretion of the Engineer, be excluded from the replacement provisions provided that the failure is a result of outside causes rather than defective material as determined by the Engineer. Outside causes include, without limitation: Extreme wear at intersections or crossover areas, unusually large amounts of heavy vehicles. Outside causes exclude, without limitation: Linear, free rolling traffic regardless of
ADT.

Pavement markings damaged by snow or ice removal operations or other natural occurrences such as flooding, earthquakes, or landslides are exempt from warranty.

5. Measurement. This Item will be measured by the foot; by each word, symbol, or shape; or by any other unit shown on the plans. Each stripe will be measured separately.

This is a plans quantity measurement Item. The quantity to be paid is the quantity shown in the proposal unless modified by Article 9.8, “Plans Quantity Measurement.” Additional measurements or calculations will be made if adjustments of quantities are required.

6. Payment. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for at the unit price bid for “Reflectorized Multipolymer Pavement Markings” of the types and colors, shape, width, size, and thickness as applicable. This price will be full compensation for materials, application of pavement markings, equipment, labor, tools, and incidentals.

Surface preparation, when shown on the plans, will be paid for under Item 678, “Pavement Surface Preparation for Markings.”

When replacement markings are required due to damage to the original markings from precipitation, and the original markings were placed at the direction of the Department, the plans quantity requirements under “Measurement” do not apply to the original and replacement markings. The Contractor will be paid for the actual quantity of original and replacement markings at the unit price bid for that bid item.

END OF SECTION 33 16 53

SECTION 33 31 00 SANITARY UTILITY SEWERAGE PIPING

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Buried Pipe and Fittings

B. Cleanouts

C. Sewage Ejector

D. Field Quality Control

1.2 RELATED SECTIONS

A. Section 31 00 00 – Earthwork

B. Section 33 05 16 – Utility Structures

C. Section 33 05 28 – Trenching and Backfilling for Utilities

1.3 MEASUREMENT AND PAYMENT

A. General

1. Measurement and payment for the site sanitary sewerage system will be either by the lump-sum method or by the unit-price method as determined by the listing of the bid item for the site sanitary sewerage system indicated in the Bid Schedule of the Bid Form.

B. Lump Sum

1. If the Bid Schedule indicates a lump sum for the site sanitary sewerage system, the lump-sum method of measurement and payment will be in accordance with Division 1 Specifications.

C. Unit Price

1. If the Bid Schedule indicates a unit price for the site sanitary sewerage system, the unit-price method of measurement and payment will be as follows:

2. Measurement:

a. Site sanitary sewerage system will be measured for payment by the linear foot of pipe, installed in place and tested, for each type and size, along the centerline of the pipe, with deductions made for manholes or other structures, measured from the inside face of each structure.

b. Utility structures will be measured separately for payment as specified in Section 33 05 16 - Utility Structures.

c. Pipe fittings, joints, pipe bedding, cleanouts, collar taps, and cutting of pipe will not be measured separately for payment, and all costs in connection

therewith will be considered as included in the linear foot measurement for pipe.

d. Support of trench excavation, maintenance, support of existing utility facilities, excavation and backfill, concrete, and incidental work pertaining to the installation of sewer pipe will not be measured separately for payment, but will be considered as included in the linear foot measurement for sewer pipe.

3. Payment:

a. Site sanitary sewerage system will be paid for at the indicated Contract unit prices for the computed quantities as determined by the measurement method specified in Article 1.3.C.1.

1.4 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI A21.11 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings

B. American Society for Testing and Materials (ASTM):

1. ASTM A74 Specification for Cast Iron Soil Pipe and Fittings
2. ASTM C12 Practice for Installing Vitrified Clay Pipe Lines
3. ASTM C14 Specification for Concrete Sewer, Storm Drain, and Culvert Pipe
4. ASTM C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
5. ASTM C425 Specification for Compression Joints for Vitrified Clay Pipe and Fittings
6. ASTM C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, using Rubber Gaskets
7. ASTM C564 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings
8. ASTM C700 Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated
9. ASTM D1785 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
10. ASTM C2321 Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
11. ASTM D2466 Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings, Schedule 40
12. ASTM D2564 Specification for Solvent Cements for Poly (Vinyl Chloride (PVC) plastic Pipe and Fittings

13. ASTM D2565 Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, Vent Pipe, and Fittings

14. ASTM D2729 Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings

15. ASTM D2855 Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

16. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals

17. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe

C. American Water Works Association (AWWA):

1. ANSI/ Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch AWWA C900 through 12 inches for Water Distribution

D. Sanitary Utility District Standards: Note that all work shall be performed and completed in accordance with the jurisdictional sanitary utility district's standard drawings and specifications.

E. The Contractor shall be responsible for obtaining all such standards and for compliance with such standards as applicable.

1.5 SUBMITTALS

A. Refer to Division 1 Specifications for submittal requirements and procedures.

B. Submit Shop Drawings showing piping layouts, sizes, types, cleanouts, and the sewage structure ejector station.

C. Submit the respective manufacturers' product data for manufactured materials and equipment.

D. Submit equipment manufacturer's printed operating and maintenance instructions in accordance with Division 1 specifications, consisting of a detailed parts list, a recommended spare parts list, and complete operation and maintenance procedures.

E. Submit certified test reports of equipment, as applicable.

1.6 SUBMITTALS FOR CLOSEOUT

A. Refer to Division 1 specifications for submittal requirements and procedures.

B. Record actual location of piping mains, valves, connections, thrust restraints, and invert elevations.

1.7 SITE CONDITIONS

A. Excavations shall be dry immediately before and after products are installed. Provide surfaces and structures to, and on which sewerage products will be installed.

B. Coordinate the installation of the sanitary sewerage system with the jurisdictional sanitary

district or utility owner.

PART 2 - PRODUCTS

2.1 BURIED PIPE AND FITTINGS

A. Requirements: Provide the types, sizes, and configurations of pipe, fittings, and miscellaneous materials and installation accessories as indicated and required. Pipe ends shall be bell and spigot, except plain end pipe shall be joined with mechanical clamp and gasket joint.

B. PVC Pipe and Fittings, 3 Inches and Smaller:

1. Pipe: Polyvinyl chloride (PVC), conforming with ASTM D1785, Schedule 40 or 80, as indicated, Type I, Grade 1, bell and spigot style solvent sealed jointed.

2. Fittings: ASTM D2466, Socket Weld, same material and schedule as pipe.

3. Joints: Socket welded with PVC solvent cement conforming with ASTM D2564 and ASTM D2855.

C. PVC Pipe and Fittings, 4 Inches and Larger:

1. Pipe: AWWA C900, Class 200, Poly (Vinyl Chloride) (PVC) Water Pipe with Bell and Spigot Ends and Flexible Ring Joints.

2. Fittings: ASTM D2466, Type 1, Grade 1, Poly (Vinyl Chloride) (PVC) Fittings, Class 200.

3. Joints: ASTM D3139 gasketed bell joints with ASTM F477 gaskets.

D. Cast Iron Soil Pipe:

1. Pipe: ASTM A74.

2. Joint Devices: ASTM C564 or ANSI A21.11, rubber gasket joint devices, as applicable.

E. Clay Pipe:

1. Pipe: ASTM C700, unperforated.

2. Joint Device: ASTM C425, compression joint.

F. Concrete Pipe:

1. ASTM C14, Class 3, unreinforced.

2. Joint Device: ASTM C443, rubber compression gasket joint.

G. Reinforced Concrete Pipe:

1. Pipe: ASTM C76, Class III, with steel reinforcement.

2. Joint Device: ASTM C443, rubber compression gasket joint

H. Pipe Accessories:

1. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, with neoprene ribbed gasket for positive seal.

2. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers traps, and other configurations as indicated or required.

I. Pipe Bedding Material: Clean sand as specified in Section 33 05 28 - Trenching and Backfilling for Utilities.

2.2 CLEANOUTS

A. At grade cleanouts shall have an adjustable sleeve-type housing, a threaded brass plug with countersunk slot, and cast-iron frame and cover.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that trench cut excavation base is ready to receive work and that excavations, dimensions, and elevations are as indicated.

3.2 PREPARATION

A. Excavations shall be free of water and extraneous material immediately before sanitary sewerage products are installed or placed. Bottoms of trenches shall have a 6-inch sand bed and shall be formed to support the bottom quadrant of the pipe and fittings. Should rock be encountered or should bedding material be unsuitable to support the products at design elevation, continue excavation to an elevation 8 inches below the design elevation and backfill with clean sand.

B. Hand trim excavations to required elevation.

C. Remove large stones or other hard matter that could damage pipe or impede consistent backfilling and compacting operations.

D. Interior of pipe, pipe fittings, valves, drains, and cleanouts shall be cleaned of foreign substances before installation.

3.3 INSTALLATION REQUIREMENTS

A. Excavate pipe trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities. Hand-trim bottom of trench to approximately 6 inches below invert of pipe.

B. Top of pipe to finished grade shall be 30 inches unless otherwise indicated or approved by the Engineer.

C. Place sand bedding material meeting the requirements of Section 33 05 28 - Trenching and Backfilling for Utilities, at trench bottom, level in one continuous layer not exceeding 8 inches in compacted depth. Compact bedding to 95 percent relative density.

D. Backfill around sides and to 6 inches above pipe with cover fill tamped in place and compacted to 95 percent relative density.

E. Test pipe distribution system and place tracer wire on top of pipe as specified herein prior to covering pipe. Backfill trench in accordance with Section 33 05 28 - Trenching and Backfilling for Utilities.

F. Maintain optimum moisture content of bedding material to attain required compaction density.

G. Install products where indicated. Remove and reinstall products that are disturbed after installation. Ends of products to which future connections will be made shall be either valved, or properly plugged, capped, and anchored.

H. Connections to existing facilities shall be made with fittings and short bends to suit the actual conditions. Connect products in accordance with the product manufacturer's installation instructions.

I. Pipe and fittings shall be set to line and grade before joints are made up. Angular deflections of joints shall not exceed the recommendations of the pipe and fitting manufacturer. Should the alignment require deflection of joints to be in excess of those recommended, use special bends to achieve the indicated deflection. Pipe ends and joints shall be prepared in accordance with the manufacturer's recommendations. As a minimum, pipe ends shall be sanded and cleaned, fittings shall be cleaned, and solvent shall be applied to both pipe and fittings.

J. Install pipe, fittings, and accessories in accordance with ASTM C12, ASTM D2321, and the manufacturer’s instructions. Seal joints water tight.

K. Lay pipe to slope gradients as indicated.

L. Install bedding at sides and over top of pipe to minimum compacted thickness of 12 inches, compacted to 95 percent relative density.

3.4 INSTALLING PIPE

A. Protect pipe and fittings during handling to prevent damage.

B. Place, shape, and compact bedding material to receive barrel of pipe.

C. Start laying pipe at the lowest point; lay true to line and grade indicated.

D. Install pipe to bear on bedding material along its entire length.

E. Do not place the pipe on blocking material of any type.

F. Do not use wedges while installing the pipe.

G. Install pipe so that bells and grooves are on the upstream end.

H. Align each section of pipe with adjoining section leaving a uniform annular space between the bell and spigot to prevent sudden offsets in flow line.

I. As each section of pipe is laid, place sufficient bedding and backfill to hold it firmly in place.

J. Apply lubricant to rubber gasket (O-rings) immediately before joining pipe sections.

K. Keep interior of sewer clean as work progresses. Where small pipe sizes make cleaning difficult, keep a suitable swab and pulling line in the pipe, and pull through each joint immediately after jointing is completed.

L. Keep trenches and excavations dry and free of water during construction and until backfilling and compaction are completed.

M. When work is not in progress, securely plug ends of pipe and fittings to prevent extraneous matter from entering pipes and fittings.

N. Cut pipe ends, which project into a sewer structure, flush with the inside face of the structure and cover exposed pipe reinforcement with grout.

O. Where length of stub is not indicated, install a 4-foot length, and seal the free end with brick masonry bulkhead or an approved stopper.

P. Obtain the Engineer's approval before covering pipe.

Q. Where indicated, place additional bedding material around and over the pipe in lifts not exceeding 6 inches before compaction. Compact each lift before placement of the next lift.

R. Accomplish compaction by methods that will avoid damage to pipe and will not disturb its alignment and grade. The use of vibratory rollers is prohibited until compacted cover over pipe has reached 3 feet or half the pipe diameter; whichever is greater.

S. Connect sanitary sewerage system to existing public sanitary sewers in accordance with requirements of the jurisdictional authority.

3.5 PIPE CLEANOUTS

A. Installation: Cleanouts shall be the same size as the pipe, with 4-inch diameter as a minimum. Cleanouts for drainage pipe shall consist of a longsweep 1/4 bend, or one or two 1/8 bends extended to the location indicated. Wall or accessible piping cleanouts shall be T-pattern, 90degree branch drainage fittings having screw plugs. Cleanouts shall be provided at the base of each riser and shall consist of a wye pattern fitting with a screw plug.

B. Form and place cast-in-place concrete pad with provision for sanitary sewer pipe ends.

C. Establish elevations and invert for inlets and outlets.

D. Mount cleanout surface hub level in grout to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. Requirements:

1. Refer to Division 1 specifications for field inspection and testing requirements.

2. Where drainage piping is located below invert slabs, conduct a ball, shuttlecock, or mandrel test to ensure that the line is free of obstructions subsequent to the placing of pervious backfill material over the line and prior to the placement of the concrete invert slab.

3. Upon completion of the test and determination that the line is free of obstructions, plug, cap, or otherwise close the open end or ends of the installed piping to prevent the entrance of debris into the lines.

4. Immediately prior to final inspection of the work, remove debris from manholes, drain inlets, and floor scupper drains. In the presence of the jurisdictional sanitary utility owner's representative prove by one of the methods specified above that the piping is free of obstructions.

5. The Contractor shall be responsible for making all necessary arrangements with the jurisdictional sanitary utility owner for performing and witnessing the required tests.

6. Request inspection of exposed piping prior to placing backfill.

7. Compaction testing of related earthwork shall be performed in accordance with applicable requirements of Section 31 00 00 - Earthwork.

8. If tests indicate work does not meet requirements, remove such work, replace, and retest at no additional cost to the District.

B. Sanitary Pipeline Tests:

1. Perform air tests on all installed sanitary sewer pipes upon completion of backfill.

2. Hydrostatically test all installed sanitary sewer force mains.

3. Test all manholes for infiltration or exfiltration.

4. Test pipe sections by the exfiltration test.

5. Test sewer 24 inches or less in diameter with low pressure.

6. Sewers with a diameter greater than 24 inches may be tested by visual inspection.

C. Exfiltration Test:

1. Tightly plug end of pipe at downstream manhole.

2. Fill sewer, at either upstream manhole or standpipe, with water.

3. Allow water to stand for not less than eight hours, and until pipe has become saturated. Refill manhole or pipe to measuring mark and begin test.

4. Exfiltration will be determined as follows:

a. If standpipe has been filled, maintain a head of water not less than 2 feet

nor more than 15 feet above highest point in the line being tested.

1) Exfiltration: that volume of water added to standpipe during a 20-hour period.

b. If upstream manhole has been filled, measure original water elevation and, after 20 hours, final water elevation. Convert difference in elevation to gallons. Head of water shall be not less than 2 feet above highest point in the line being tested or not less than 2 feet above existing groundwater table, whichever is greater.

1) Exfiltration: that volume of water calculated from the difference in elevations during a 20-hour period.

5. Allowable leakage:

a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.

b. If leakage exceeds permissible loss, sewer section will not be accepted.

c. Do not conduct another exfiltration test until conditions of groundwater surrounding pipe return to a condition similar to those existing at beginning of test period.

D. Infiltration Test:

1. Tightly plug end of pipe at upstream manhole.

2. Install a 90-degree notch weir in downstream manhole.

3. Allow water to accumulate behind weir until overflow is constant.

4. Allowable leakage:

a. Not more than 200 gallons per 24 hours per diameter inch per mile of sewer.

b. If measured infiltration is more than the allowable rate, sewer section will not be accepted.

E. Low-Pressure Air Test:

1. Clean and set sections of pipe to be tested before starting air test.

2. Plug pipe outlets with pneumatic plugs capable of resisting internal testing pressures without requiring external bracing.

3. Immediately following pipe cleaning and wetting, slowly supply air to plugged pipe until internal air pressure reaches 4 psi. Allow at least two minutes for temperature to stabilize before proceeding, except slowly add air to maintain a 3.5 psig to 4 psig pressure. While temperature is stabilizing, spray plugs, pipes, and hoses with soap solution and eliminate air leaks.

4. After temperature has stabilized, measure time required for pressure to drop from 3.5 psig to 2.5 psig. If measured time exceeds allowable time, pipe will not be accepted.

5. Time, in seconds, for pressure to drop from 3.5 to 2.5 psig shall be not less than the following: time for intermediate lengths shall be interpolated:

Length of Pipe (Ft)	Diameter in Inches						
	8	10	12	15	18	21	24
25	18	28	40	62	89	121	158
50	35	55	79	126	178	243	317
75	53	83	119	186	267	364	475
100	70	110	158	248	356	485	634
125	83	38	198	309	444	595	680
150	100	165	238	375	510	595	680
175	123	193	277	425	510	595	680
200	141	120	317	425	510	595	680
225	158	248	340	425	510	595	680
250	176	275	340	425	510	595	680

F. Visual Test Method: Slowly pull a television camera through sewer and inspect for visual leaks and cracks in pipe. Repair leaks, then re-inspect pipe.

G. Joint Pressure Testing:

1. Insert sealing packer with joint testing capability, into sewer line.

2. Place sealing packer around joint and pressure test joint. If a drop in air pressure occurs, reseal the joint.

3. Repeat procedure for each joint.

H. Criteria for Acceptance: The section of sewer being tested will not be accepted if test results exceed allowable leakage or take less time than minimum holding time. If pipe proves to be unacceptable, immediately repair defective materials and installation. The Contractor will not be permitted to change to another test if original test method reveals system has failed.

I. Obstruction Tests:

1. Perform field tests to verify that installed sanitary systems are free from obstructions.

2. Remove obstructions by excavating at the apparent obstruction and repairing or replacing the defective pipe.

END OF SECTION 33 31 00

SECTION 33 41 00 **STORM SEWAGE SYSTEMS**

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section specifies the requirements for providing storm sewers and appurtenant structures.

1.2 QUALITY ASSURANCE

A. Reference Standards Applicable to this Section

1. AASHTO: American Association of State Highway and Transportation Officials

a. M 36: Specification for Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.

b. M 190: Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.

c. M 252: Specification for Corrugated Polyethylene Drainage Tubing.

d. M 294: Specification for Corrugated Polyethylene Pipe 12 inch to 36-inch diameter.

2. ASTM: American Society for Testing and Materials

a. A 48: Specification for Gray Iron Castings.

b. A 74: Specification for Cast Iron Soil Pipe and Fittings.

c. C 40: Test Method for Organic Impurities in Fine Aggregate for Concrete.

d. C 76: Specifications for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

e. C 150: Specification for Portland Concrete

f. C 443: Joints for Circular Concrete Sewer and Culvert Pipe Using Rubber Gaskets

g. C 881: Specification for Epoxy- Resin-Base Bonding Systems for Concrete

h. D 618: Conditioning Plastics and Electrical Insulating Materials for Testing

i. D 1248: Polyethylene Plastics Molding and Extrusion Material

j. D 1693: Environmental Stress Cracking of Ethylene Plastics

k. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120

l. D 2239: Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controller Inside Diameter

m. D 2412: Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

n. D 2447: Specifications for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

o. D 2466: Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

p. D 2467: Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

q. D 2564: Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

r. D 2665: Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings.

s. D 2729: Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

t. D 2855: Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

u. D 3035: Specifications for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter.

v. D 3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

w. D 3261: Specification for Butt Heat Fusion of Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

x. D 3350: Specification for Polyethylene Plastics Pipe and Fittings Material.

y. F 402: Safe Handling of Solvent Cements and Primers Used for Joining Thermoplastic Pipe and Fittings.

z. F405: Specification for Corrugated Polyethylene (PE) Tubing and Fittings.

aa. F 412: Standard Terminology Relating to Plastic Piping Systems.

bb. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

cc. F 656: Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Pipes and Fittings.

dd. F 714: Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

ee. F 913: Standard Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

ff. F 667: Specification for Large Diameter Corrugated Polyethylene Tubing and

Fittings.

3. Federal Specification

a. SS-S-210A and Latest Amendments: Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints.

1.3 SUBMITTALS

A. In accordance with Section 01 of these Specifications, the following shall be submitted:

1. Certificates

a. Manufacturer's certificates and load tickets stating that materials meet specified requirements.

2. Shop Drawings

a. Shop Drawings and details of all storm sewers and drains, including relationship to other systems and true position and details of all interfaces, connections, inlets, clean- outs, manholes, alignment and grade, changes of direction, offsets, bedding and protection, materials, manufacturer's installation and connection instructions and recommendations, and all other pertinent data.

PART 2 - PRODUCTS

2.1 GENERAL

A. Products for use within Port Arthur right-of-way shall meet the applicable requirements.

2.2 PIPES AND FITTINGS

A. Reinforced Concrete Pipe (RCP)

1. ASTM C 76, bell-and-spigot, Class III, Wall B.

B. Corrugated Galvanized Metal Pipe (CGMP)

1. AASHTO M 36, coated and paved in accordance with AASHTO M 190, Type C coating for pipe and Type A coating for coupling bands.

C. PVC Pipe in accordance with the following:

1. ASTM D 1785.

2. ASTM D 2241.

3. ASTM D 2466.

4. ASTM D 2467.

D. PE Pipe

1. ASTM D 2447.

2. ASTM D 3035.

3. ASTM D 3350 Type PE 3408.

4. ASTM F 714 Type PE 3408.

2.3 JOINTS

A. Gaskets for RCP in accordance with the following:

1. Federal Specification SS-S-210A.

2. ASTM C 443.

B. All joints in PVC plastic pipe shall be solvent cemented in accordance with the following:

1. ASTM D 2564.

2. ASTM D 2672.

3. ASTM D 2855.

4. ASTM F 402.

5. ASTM F 656.

C. All joints in PE plastic pipe shall be fusion butt-welded in accordance with ASTM 3261.

2.4 DRAINAGE STRUCTURES

A. Manhole

1. Type as indicated on the Drawings and conforming to applicable Standards for Port Arthur or Jefferson County Right-of-Way, or LSC Property. Frame and Cover ASTM A 48 Class 35 B.

B. Inlet

1. Type as indicated on the Drawings and conforming to applicable Standards in Port Arthur or Jefferson County Right-of-Way, or LSC Property. Frame and Grate ASTM A 48 Class 35 B.

C. Reinforcing Steel

1. As specified in Section 032100 - Concrete Reinforcement of these Specifications.

D. Cast-in-Place Concrete (Class 3000)

1. As specified in Section 321373.19 - Cast-in-Place Concrete of these Specifications.

E. Mortar (Type M)

2.5 CEMENT-STABILIZED SAND BACKFILL

A. Aggregate

1. Use clean sand; deleterious materials in the sand shall not exceed the following limitations, by weight:

Material removed by denatation	5.0 percent
Clay lumps	0.5 percent
Other deleterious substances such as coal, shale, coated grains of soft flaky particles.	2.0 percent

2. Gradation Requirements:

Retained on 3/8-in. sieve	0 percent
Retained on 1/4-in. sieve	0 - 5 percent
Retained on 20-mesh sieve	15 - 50 percent
Retained on 100-mesh sieve	80 - 100 percent

3. Color test per ASTM C 40, color not darker than standard color.

B. Cement

1. ASTM C 150, Type I or II.

C. Water

1. Potable, from municipal supplies approved by the State or City Health Department.

D. Mixture

1. Use at least 1-1/2 sacks of cement per cubic yard of mixture. Use amount of water required to provide mix suitable for mechanical hand tamping and mix in approved mixer. Stamp load tickets at plant with time of loading. Material not in place within 1-1/2 hours after loading or that has obtained an initial set will be rejected and shall be removed from the Site and replaced with new acceptable mixtures at no additional cost to OWNER.

2.6 TIMBER POSTS

A. Southern Pine or Douglas Fir, pressure-treated in accordance with American Wood Preservers' Association (AWPA) Standards.

PART 3 - EXECUTION

3.1 GENERAL

A. All storm sewer work performed within Huntsville right-of-way shall meet the applicable requirements.

3.2 EXCAVATION

A. All excavation shall be in accordance with Section 330528 – Trenching & Backfill for Utilities of these Specifications.

B. Perform excavation for storm sewer and storm sewer drainage structures to line and grade required as shown on the Drawings and as specified herein.

C. If the excavation exceeds the permissible dimensions, extend the encasement or install pipe of higher strength, as directed.

D. Prevent surface or ground water from flowing into excavation. Install, operate, and maintain dewatering system to convey water away from excavation. Notify the Engineer in writing of delays to the Work caused by water intrusion.

3.3 PIPE ENCASEMENT

A. Place cement-stabilized sand bedding before laying pipe. Bedding shall be compacted and shaped to fully support the pipe.

B. After the pipe is laid, place cement-stabilized sand beside and above the pipe in 4 in. lifts to the limits shown on the construction drawings. Compact individual lifts with a hand-operated, motorized tamper; exercise care to avoid damaging the pipe.

3.4 LAYING PIPE

A. Install and joint pipe in accordance with the pipe manufacturer's instructions and as specified herein.

B. Provide a minimum of 6 in. clearance between storm sewer and sanitary sewer.

C. Seal open end of pipe with plug when pipe laying operation is temporarily halted. Plug shall remain in place until operation restarts.

3.5 BACKFILL

A. On completion of construction, backfill the excavation as specified in Section 312300 – Excavation, Grading, and Fill of these Specifications and in accordance with details on the construction drawings. Backfill only when the written approval of the Engineer is obtained to do so.

3.6 CONSTRUCTION OF MANHOLES AND INLETS

A. General

1. Construct manholes and inlets as soon as practical after sewer lines into or through the manhole or inlet locations are completed.

2. Construct manholes and inlets at locations and of the type indicated. All manholes within 9 feet of existing water lines shall be watertight.

B. Manholes

1. Provide base of the shape and size required with a minimum thickness of 12 inches.

2. Place axis of manholes directly over the centerlines of the lines, unless otherwise indicated.

3. Shall be constructed of either precast or cast-in-place concrete.

C. Inlets

1. Shall be constructed of either precast or cast-in-place concrete.

3.7 CLEANUP

A. Remove temporary structures, rubbish, waste materials, and excess excavated materials from the Site and dispose of legally.

END OF SECTION 33 41 00