PROJECT MANUAL VOLUME 1

JANUARY 6, 2025

New Caney High School Extracurricular Improvements - Phase III

NEW CANEY ISD

NEW CANEY, TEXAS

VLK Project No.

23-155.00

OWNER:

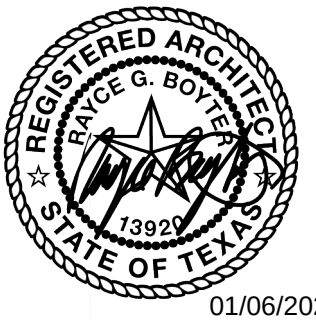
NEW CANEY ISD
21580 Loop 494
New Caney, Texas 77357

OWNER

New Caney
Independent School District
21580 Loop 494
New Caney, Texas 77357

ARCHITECT

VLK
Rayce Boyter
20445 State Hwy 249, Suite 350
Houston, Texas 77070
Main Phone: 281.671.2300
www.vlkarchitects.com



01/06/2025

CIVIL ENGINEER

Talon Engineering, LLC
Firm Registration Number: F-24281
Brian W. Reed, P.E.
1118 Wolfs Knoll
Houston, Texas 77094
Main Phone: 832.287.9874
www.taloncivil.com

1-6-2025

LANDSCAPE/IRRIGATION

GreenScape Associates
Brett Legendre, RLA
5030 Bryan Road
Richmond, Texas 77469
Main Phone: 281.341.9975
www.greenscapeassociates.com

PROJECT MANUAL VOLUME 1

JANUARY 6, 2025

New Caney High School Extracurricular Improvements - Phase III

NEW CANEY ISD
NEW CANEY, TEXAS

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23-155.00

FOOD SERVICE

FCA Design, Inc.
Randy Reich
11200 Broadway, Suite 2362
Pearland, Texas 77584
Main Phone: 281.520.3431
www.fcadesign.com

STRUCTURAL ENGINEER

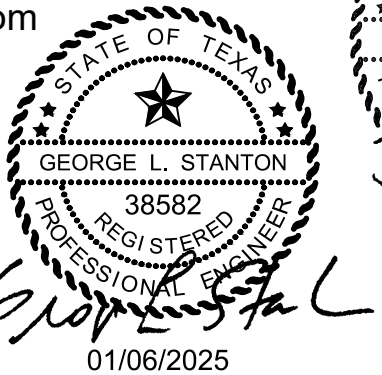
Matrix Structural Engineers, Inc.
Firm Registration Number: F- 2640
Khalil Tabaja, P.E.
5177 Richmond Avenue, Suite 670
Houston, Texas 77056
Main Phone: 713.664.0130
www.matrixstructural.com

Matrix Structural Engineers
TBPE Firm Registration No. F-2640

01/06/2025

MEPT ENGINEER

Stanton Engineering Group
Firm Registration Number: F-016332
George Stanton, PE
1300 W. Sam Houston Parkway S, Suite 121
Houston, Texas 77042
Main Phone: 713.300.9292
www.stanton-eng.com



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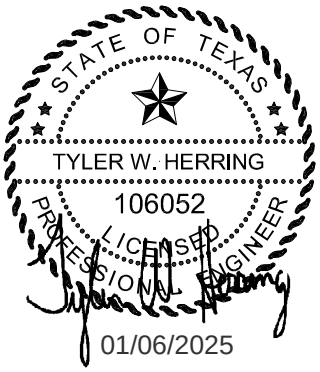

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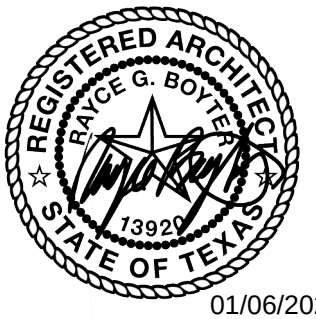

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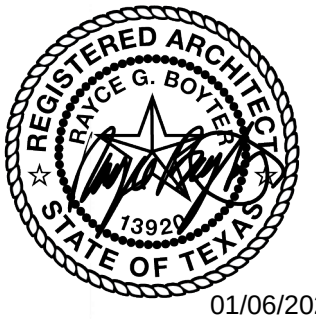

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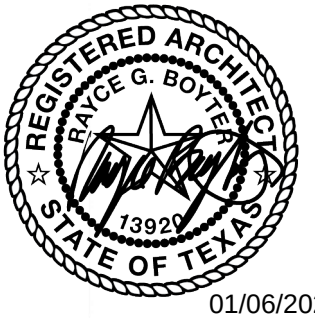

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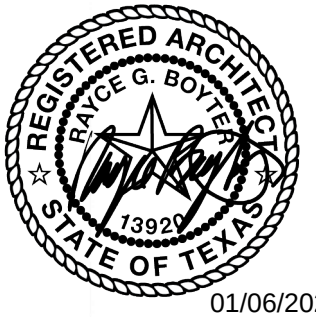

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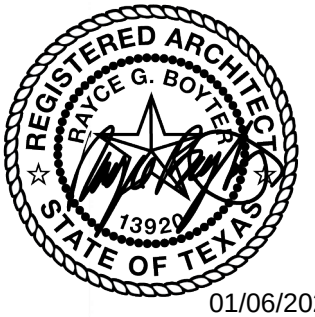

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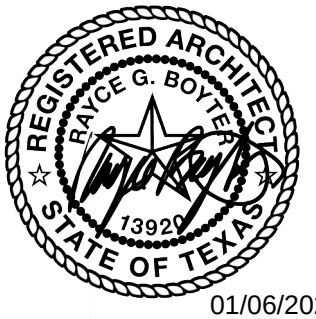

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REQUEST FOR COMPETITIVE SEALED PROPOSALS
CSP JOB #001-2023

Project: **New Caney High School**
Extracurricular Improvements-Phase III

Location: **New Caney High School**
22555 Eagle Drive
New Caney, TX. 77357

ISSUED BY (Owner):

New Caney Independent School District
22784 Hwy 59S Building E
Porter, TX 77365

SUBMIT INQUIRIES TO:

Name: Tanci Foster, Project Manager
22784 Hwy 59S Building E, Porter, TX 77365
Email: tfoster@newcaneyisd.org

New Caney ISD website: www.newcaneyisd.org

SECTION 1 – PROJECT OVERVIEW

Project Overview and Scope: New Caney Independent School District ("NCISD," "District," "Owner") is seeking **Competitive Sealed Proposals** from qualified proposers to provide construction services for the New Caney High School, Extracurricular Improvements-Phase III located at 22555 Eagle Drive New Caney, TX 77357. The project scope of work consists of a new 30,281 square foot field house, 400 square foot pressbox/ticketing, new track and football field, practice field and covered practice field.

Estimated Budget: The estimated budget for this project is **$19,638,000**

Award/Contract Approval: This procurement, any award under this procurement, and the resulting contract, if any, is subject to approval by the NCISD Board. Subsequent to required approval, the only person authorized to commit NCISD contractually is the Superintendent or his designee. This solicitation is an invitation for sealed proposals and neither this solicitation nor the response or the proposal from any prospective proposer/contractor shall create a contractual relationship that would bind NCISD until such time as both NCISD and the selected proposer/contractor sign a legally binding contract, which includes, without limitation, the terms required by NCISD.

Pre-Proposal Meeting: Pre-Proposal meeting agenda will include review of topics that may affect proper preparation and submittal of proposals and is scheduled for **9:30 a.m. on Wednesday, January 15, 2025** at 22784 Hwy 59S Building E, Porter, TX 77365. Attendance at the pre-proposal meeting is not mandatory, but all proposers are highly encouraged to attend.

Proposal Deadline; Opening Time/Location: Sealed Base Proposals for the construction work to be performed as required and/or contemplated under this request for competitive sealed proposals and as described herein and in the construction documents will be received no later than **February 4, 2025 by 2:00 p.m.** Sealed Alternate Proposals for the construction work to be performed as required and/or contemplated under this request for competitive sealed proposals and as described herein and in the construction documents will be received no later than **February 4, 2025 by 3:00 p.m.** Proposals will be publicly opened and read aloud at **3:05 p.m. on February 4, 2025**.

Proposals shall be submitted by hard copies delivered by U.S. Postal mail, courier, or hand delivery to NCISD on or before the date and time set to receive proposals. Proposers shall submit 1 original and 1 copy of proposals in a sealed envelope and are responsible for ensuring that their proposals are time-stamped to evidence timely submission. Hard copies of proposals will only be accepted at NCISD's Facilities and Construction Building, located at 22784 Hwy 59S Building E, Porter, TX 77365, between the hours of 8:00 a.m. and 3:00 p.m., Monday through Friday, on NCISD business days.

Proposals that have been opened may not be changed for the purpose of correcting an error in the price. Other than price, a proposer may have the right to change any other error or mistake in the proposal as may be permitted by applicable law and subject to the approval of NCISD, unless such change would be in contravention of statutory or common law requirements or unless such change would give an unfair advantage to the proposer making such change.

Contract Term: Actual work to be performed and the schedule for performance under this solicitation will be upon the terms, conditions, and timelines agreed upon by NCISD and the selected contractor. **Time is of the essence for this project. All Work listed in the construction documents shall be substantially completed as follows:**

The entire Project except for the Athletic Pre-engineered Building – June 29, 2026.
The Athletic Pre-engineered Building – August 3, 2026

Final Completion shall be no later than thirty (30) days following each Substantial Completion date.

Reservations and Waivers: This procurement solicitation shall be in accordance with applicable law and NCISD policies and general terms, including the following:

1. This Request for Competitive Sealed Proposals does not obligate NCISD to award a contract or pay any costs incurred by the proposer in the preparation and submittal of a proposal. NCISD assumes no financial responsibility for any costs incurred by proposers in developing and submitting a proposal, participating in pre-bid meetings, or any other costs incurred by proposers in connection with this procurement solicitation.

2. **NCISD, IN ITS SOLE DISCRETION, RESERVES THE RIGHT TO ACCEPT ANY PROPOSAL AND/OR REJECT ANY AND ALL PROPOSALS OR A PART OF A PROPOSAL, WITHOUT REASON OR CAUSE, SUBMITTED IN RESPONSE TO THIS SOLICITATION.**

3. **NCISD RESERVES THE RIGHT TO REJECT ANY NON-RESPONSIVE OR CONDITIONAL PROPOSAL.**
4. **NCISD RESERVES THE RIGHT TO WAIVE ANY FORMALITIES, IRREGULARITIES, AND/OR TECHNICALITIES IN THIS SOLICITATION, THE CONSTRUCTION AND/OR PROCUREMENT DOCUMENTS, AND/OR ANY PROPOSALS RECEIVED OR SUBMITTED.**

5. **BY SUBMITTING A PROPOSAL, PROPOSER AGREES TO WAIVE ANY CLAIM IT HAS OR MAY HAVE AGAINST NEW CANEY INDEPENDENT SCHOOL DISTRICT, AND/OR NCISD'S BOARD MEMBERS, ADMINISTRATORS, EMPLOYEES, AND/OR AGENTS ARISING OUT OF OR IN CONNECTION WITH (1) THE ADMINISTRATION, EVALUATION, OR RECOMMENDATION OF ANY PROPOSAL; (2) ANY REQUIREMENTS UNDER THE SOLICITATION, PROCUREMENT PACKAGE, OR RELATED DOCUMENTS; (3) THE REJECTION OF ANY PROPOSAL OR ANY PART OF ANY PROPOSAL; AND/OR (4) THE AWARD OF A CONTRACT, IF ANY.**

6. NCISD reserves the right to withdraw/cancel this solicitation at any time for any reason, remove any scope component for any reason and to issue such clarifications, modifications and/or amendments as deemed appropriate by NCISD, in its sole discretion.

7. A response to this procurement solicitation is an offer to contract with NCISD based upon the terms, conditions, scope of work, and specifications contained in this procurement solicitation and the construction documents. A contract is not formed unless and until a proposal is accepted and awarded by NCISD after approval by the NCISD Board of Trustees. NCISD will utilize the AIA Document A101-2017 contract, as modified by NCISD, along with the AIA Document A201 General and Supplementary Conditions, as modified by NCISD. NCISD's modifications to the AIA Documents are included herein as Attachment Exhibit C. Any exceptions to NCISD's modifications to the AIA Documents must be clearly indicated in the proposer's submission. Each Proposer, by making its proposal, represents that the Proposer has read, understands, and agrees to NCISD's modifications to the AIA Documents.

8. A proposal that has been submitted may be withdrawn prior to the deadline for submission of proposals.

9. Proposals received will become a part of NCISD's official files without further obligation to the respondents.

10. Respondents shall not, under penalty of law, offer any gratuities, favors, or anything of monetary value to any officer or employee of NCISD, or to any consultant, employee, or member of NCISD for the purpose of or having the effect of influencing favorable disposition toward their own proposal or any other proposal submitted hereunder.

11. No employee, officer or member of NCISD shall participate in the selection, development of a response to this procurement solicitation, award or administration of a contract resulting from this procurement solicitation if a conflict of interest, real or apparent, would be involved.

12. Proposers shall not engage in any activity that will restrict or eliminate competition. This does not preclude joint ventures or subcontracts.

SECTION 2 – INSTRUCTIONS TO PROPOSERS

1. **Definitions:**

Procurement Documents include the procurement requirements and the proposed contract documents. The procurement requirements consist of this Request for Competitive Sealed Proposals, including its exhibits and attachments, and all addenda. The proposed Contract Documents consist of the AIA Document A101-2017 contract, as modified by NCISD; Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD; AIA Document A201 General Conditions, as modified by NCISD; the Drawings and Specifications. The AIA Documents, as modified by NCISD, are included herein as Exhibit C.

2. **Review of Construction Documents**

A complete set of documents (collectively, "Procurement Documents") shall be used in preparing a proposal; neither NCISD nor NCISD's architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete sets of construction and/or procurement documents. Each prospective proposer should carefully review the construction documents and take such steps as may be reasonably necessary to ascertain the resulting contract performance requirements. Failure to do so will not relieve proposers from the responsibility of estimating properly the difficulty/level of effort or cost of successfully performing any resulting contract. After the proposals have been opened, NCISD shall have the right to review the proposals and examine the credentials and qualifications of each proposer to determine whether any or all of the proposals are responsive and to make a determination as to whether any one or more proposers are qualified, responsible contractors.

Proposers shall carefully study and compare the Procurement Documents with each other, shall examine the site and local conditions, and shall at once report to the architect errors, inconsistencies, or ambiguities discovered.

3. **Explanation to Proposers; Questions; Registration with Architect**

Any explanation desired by a prospective proposer regarding the meaning or interpretation of the Procurement Documents must be requested in writing and with sufficient time allowed (a minimum of ten (10) calendar days before the date set to receive proposals) for a response to reach prospective proposers before the submission of their proposals. Any NCISD interpretations, corrections, and/or changes to the procurement or construction documents will be in the form of an addendum. Interpretations, corrections and changes of the Procurement Documents made in any other manner will not be binding, and Proposers shall not rely upon them.

All such addenda shall be posted where the original procurement documents were placed. Receipt of any addenda issued by NCISD shall be acknowledged by the proposer with the proposal submission.

Procurement Documents may be obtained from the issuing office designated in the Advertisement for Sealed Proposals in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Proposers who return the Procurement Documents to the issuing office in good condition and in good order within ten days after proposal opening. The cost of replacement of missing or damaged Procurement Documents will be deducted from the deposit. A Proposer receiving a Contract award may retain the Procurement Documents and the Proposer's deposit will be refunded.

- Additional complete sets of Procurement Documents, if available, may be obtained by Proposers and sub-proposers from the issuing office for the cost of reproduction and mailing, which costs are not refundable. It shall be understood by entities obtaining additional sets and paying the reproduction and mailing costs

that such additional sets remain the Owner's exclusive property and shall be returned to the office from where the Procurement Documents were issued.

All questions and/or requests for information must be sent directly to the architect and responsible party/consultant via email:

1. Architectural/General – **VLK Architects** **Rayce Boyter**
   20445 State Hwy 249, Suite 350
   Houston, TX 77070 Email: rboyter@vlkarchitects.com

2. Civil – **Talon Engineering** **Brian Reed**
   16225 Park Ten Place, Suite 500
   Houston, TX 77084 Email:brian@taloncivil.com

3. Structural – **Matrix Structural** **Khalil Tabaja**
   5177 Richmond Avenue, Suite 670
   Houston TX, 77056 Email:ktabaja@matrixstructural.com

4. MEP – **Stanton Engineering Groupo** **Michael Stanton**
   1300 W Sam Houston Pkwy S, Suite 121
   Houston, TX 77042 Email: michael@stanton-eng.com

All questions and/or requests for information shall be responded to in writing by return email only to the original sender, if there are no changes to the Contract Documents.

For all proposers preparing to submit a proposal for the work enumerated in the construction documents to NCISD, please **register with NCISD's architectural firm for this project**: VLK Architects. This registration will allow NCISD to maintain a proposer list and have the opportunity to submit responses to proposers' questions/requests for information equally with all proposers.

Prospective proposers are responsible for obtaining issued addenda to the request for competitive sealed proposals to ensure they have the most current and complete Procurement Documents.

4. **General Requirements**
   a. NCISD is seeking proposals from qualified, responsible contractors to provide construction services.
   b. The contractor must have the administrative and fiscal capability as well as experience to provide and manage the services requested.
   c. The contractor must comply with all applicable federal, state, and local laws, ordinances, rules, regulations and orders of all authorities having jurisdiction over the contract.
   d. The contractor must be adequately insured and bonded.
   e. The contractor must employ qualified personnel with adequate training and experience and in adequate numbers.

5. **Proposer Eligibility for Contract Award**

In order for a proposer to be eligible to be awarded a contract, the proposal must be responsive to the solicitation and NCISD must be able to determine that the proposer is responsible to perform the resulting contract satisfactorily.

Responsive proposals are those that comply with all material aspects of the solicitation, conform to the Procurement Documents, and meet the requirements set forth in this solicitation. Proposals that do not comply with the terms and conditions of the solicitation will be rejected as non-responsive.

Each proposer shall complete, and submit with the proposal, the applicable forms contained in the solicitation. When a special license or permit is required by Federal, State or Local law or ordinance or required by a company or otherwise to perform the work, the proposer must be properly licensed prior to submitting a proposal to NCISD and must furnish evidence of such licensing or credentials with the proposal.

Responsible proposers, at a minimum, must meet all of the following requirements:

- Be an experienced contractor who has served as a prime contractor on similar construction projects for schools/governmental entities and be knowledgeable about requirements for construction of and building elements for schools including, without limitation, applicable building code requirements;
- Provide a warranty and support for any equipment installed as part of the construction services;
- Possess or is able to obtain adequate financial resources as required to perform under any contract resulting from this procurement solicitation;
- Have a responsible safety record, as detailed in this procurement solicitation;
    - Proposers must submit with their sealed proposal the following evidence of proposer's safety record: proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years, a loss analysis from the proposer's insurance carrier, and a loss history covering all lines of insurance coverage carried by the proposer.
- **Be able to obtain payment and performance bonds of the types and in the amounts described in this procurement solicitation;**
    - Proposers must provide a letter of statement from a bonding company that the proposer general contractor is eligible to obtain both payment and performance bonds of the types described in this procurement solicitation**. Proposers must include such letters in their proposals.**
    - Payment and performance bonds shall be provided after the proposal/contract award in order to proceed with contract execution.
    - Proposers shall include the related bond cost within their proposal amount.
- **Comply with all prevailing wage rate requirements;**
    - The contractor who is awarded a contract resulting from this procurement solicitation must pay not less than the prevailing wage rates determined by NCISD to a worker employed by it in the execution of a contract and must keep a record of such, as detailed in this procurement solicitation.
- **Be able to obtain all required permits.**
    - All permit costs, inspection costs by governmental authorities having jurisdiction and associated fees, including but not necessarily limited to, building permits, sprinkler permits, canopy permits, fence permits, etc. will be paid by the selected proposer.
    - Proposers shall include the related permitting and inspection costs within their proposal amount.
- Submit all required proposal forms. If there are any missing proposal form pages, proposers may be disqualified.
- Be able to comply with the required performance schedule, taking into consideration all existing business commitments;
- Have necessary management and technical capability to perform any resulting contract;
- Be qualified as an established firm regularly engaged in the type of business to provide the items/work required by this solicitation;
- Be registered to do business in the State of Texas;
- Be in good standing with the State of Texas;
- Be otherwise qualified and eligible to receive a contract award under applicable laws and regulations.

Proposals deviating or taking exceptions to the solicitation requirements may not be considered. A person is not eligible to be considered for award of this solicitation or any resulting contract or to be a subcontractor of the proposer or prime contractor if the person assisted in the development of this solicitation or any part of this solicitation or if the person participated in a project related to this solicitation when such participation would give the person special knowledge that would give that person or a prime contractor an unfair advantage over other proposers.

6. **Preparation for Proposal; Proposal Submittal**

a. A proposal shall be complete, must include information provided on the attached forms, and may include any other forms or documents to support the proposal submitted by the contractor and shall be signed by an authorized official of the company submitting the proposal. The person signing the proposal shall initial any changes or erasures appearing on the proposal forms.

b. Proposers may respond to this CSP using by submitting hard copies of proposals. A proposal shall be submitted by delivering proposals no later than the exact date/time and at the place indicated in the solicitation. The required documentation and forms must be completed, signed, scanned, and enclosed in Proposer's sealed envelope. Hard copies of proposals will only be accepted at NCISD's Facilities and Construction Building, located at 22784 Hwy 59S Building E, Porter, TX 77365, between the hours of 8:00 a.m. and 3:00 p.m., Monday through Friday, on NCISD business days. The envelope shall identify the name and address of the proposer and shall contain the proposal security and other required documents.

c. All proposal packages must be sealed and must be clearly marked with the following:
- Proposer's name, address and telephone number
- Project Description/Title
- Proposal Opening Date/Time

All hard copies of proposals shall be submitted to:

NEW CANEY INDEPENDENT SCHOOL DISTRICT
Attn: Tanci Foster
NCISD Facilities and Construction Building
22784 Hwy 59S Building E
Porter, TX 77365

c. **Proposal security shall be submitted with each proposal in the amount of ten percent (10%) of the Base Proposal amount.**

7. **Selection Criteria**

In accordance with Sections 2269.153, 2269.155, and 2269.055 of the Texas Government Code, NCISD will evaluate proposals on the basis of the following selection criteria:

Selection Criteria Weight Table	
Detailed Methodology for Scoring	**Criteria Weight**
Price – Proposed Price Proposers will receive an assigned share of the total available points for this criterion based on the total monetary value of the Proposal according to banded point categories shown in the "Table of Awarded Points," below. A formula will be used as follows to determine the award band for proposals based on each proposer's percentage above the low bid: Percentage Above Low Bid=(Your combination of fees and general conditions/lowest proposed combination of fees and general conditions. The result of the formula will be used to proportion the points awarded based on the "Table of Awarded Points," below.	**50**
Proposer's Experience & Reputation The Owner will consider the proposer's experience and reputation and the proposer's answers to the Questionnaire, including, but not limited to, the record of past performance, general reputation of the proposer, and the proposer's knowledge, reliability, character, integrity, skill, and stability; the proposer's experience completing projects of similar size and scope in the Greater Houston Area, the proposer's experience with NCISD, and the proposer's reputation for handling warranty work. Proposer's references (listed in proposer's A305) will be reviewed and evaluated.	**15**
Quality of Proposer's Goods or Services Proposer demonstrates consistent and average past and current workload to staff ratio, showing ability to adequately staff the work and company stability. Proposer shows no or limited past history of claims, suits, and failure to perform. Proposer shows ability to maintain cost with no cost increases. Proposer has a record of timely completion of work, compliance with laws, and warranty service. Owner will consider the answers to the Questionnaire which relate to the quality of the Proposer's services.	**15**
Whether Proposer's financial capability is appropriate to the size and scope of the project Proposer's financial and technical resources will be evaluated. Proposer has a positive asset to liability ratio and adequate bonding capacity. Evaluation of Proposer's responses to Financial Information Questionnaire of this RFP.	**5**
Proposer's Proposed Personnel Proposer's individual personnel proposed for the work in the RFP demonstrate similar project experience by showing high proportion of Montgomery County school district/governmental entity work, the proposer's experience completing projects in the Greater Houston Area of similar size, scope, comparable cost, complexity, and timeframe to the work in the RFP. Organizational approach to the project is clear. Owner will review and evaluate the answers to the Questionnaire and resumes in proposer's A305.	**5**
Proposer's Safety Record NCISD will consider the safety record of the proposer in determining to whom to award a contract resulting from this procurement solicitation. The safety record shall be as defined in this RFP.	**2**
Proposer's Ability to Complete Project on Time Proposer's ability to complete project on time; Proposer's proposed construction schedule meets or exceeds the Substantial Completion and Final Completion dates set forth herein.	**5**
Proposer's Performance in Responding to Warranty Proposer has a positive demonstrated performance in responding to warranty claims.	**3**
Total	**100**

Table of Awarded Points

Percentage Above Low	Percentage of Available Points Allocated
0% to 0.0125%	100.00%
0.0126% to 0.25%	99.00%
0.26% to 0.51%	97.50%
0.52% to 0.77%	96.00%
0.78% to 1.03%	94.50%
1.04% to 1.29%	93.00%
1.3% to 1.55%	91.50%
1.56% to 1.81%	90.00%
1.82% to 2.07%	88.50%
2.08% to 2.33%	86.50%
2.34% to 2.59%	84.50%
2.6% to 2.85%	82.50%
2.86% to 3.11%	80.50%
3.12% to 3.37%	78.50%
3.38% to 3.63%	77.50%
3.64% to 3.89%	76.50%
3.9% to 4.15%	75.50%
4.16% to 4.41%	74.50%
4.42% to 4.67%	73.50%
4.68% to 4.93%	72.50%
4.94% to 5.19%	71.50%
5.2% to 5.45%	70.50%
5.46% to 5.71%	69.50%
5.72% to 5.97%	68.50%
5.98% to 6.23%	67.50%
6.24% to 6.49%	66.50%
6.5% to 6.75%	65.50%
6.76% to 7.01%	62.50%
7.02% to 7.27%	59.50%
7.28% to 7.53%	56.50%
7.54% to 7.79%	53.50%
7.8% to 8.05%	50.50%
8.06% to 8.31%	47.50%
8.32% to 8.57%	44.50%
8.58% to 8.83%	41.50%
8.84% to 9.09%	38.50%
9.1% to 9.35%	35.50%
9.36% to 9.61%	32.50%
9.62% to 9.87%	29.50%
9.88% to 10.13%	26.50%
10.14% to 10.24%	23.50%
10.25% to 11%	17.50%
11.01% to 12%	11.50%
12.01% to 13%	5.50%
13.01% to 100%	0.00%

8. **Terms and Conditions**

This procurement solicitation shall be in accordance with applicable law, including Subchapter D of Chapter 2269 of the Texas Government Code (Competitive Sealed Proposal Method of Procurement), NCISD policy, and the following terms and conditions of this procurement solicitation:

a. Contract Award. Award of a contract, if any, will be made to the proposer who submits the proposal that offers the best value for NCISD, based on (a) the selection criteria in this request for competitive sealed proposals and the weighted value for those criteria listed in this procurement solicitation; and (b) NCISD's ranking evaluation. Tex. Gov't Code § 2269.155(a). NCISD must first attempt to negotiate a contract with the selected proposer. NCISD and its architect and/or engineer may discuss with the selected proposer options for a scope or time modification and any price change associated with the modification. Tex. Gov't Code § 2269.155(b). If NCISD is unable to negotiate a satisfactory contract with the selected proposer, NCISD must, formally and in writing, end negotiations with that proposer and proceed to the next proposer in the order of the selection ranking until a contract is reached or all proposals are rejected. Tex. Gov't Code § 2269.155(c).

b. Taxes. NCISD is exempt from taxation, and no proposal shall include any costs for taxes to be assessed against NCISD.

c. Appropriated Funds. The purchase of services and/or products that arises from this solicitation is contingent upon the availability of appropriated funds. In addition to other termination rights contained in the resulting contract, if any, NCISD shall have the right to terminate the resulting contract at the end of the current or each succeeding NCISD fiscal year if funds are not appropriated by NCISD's Board of Trustees for the next fiscal year that would permit continuation of the resulting contract. If funds are withdrawn or do not become available, NCISD reserves the right to terminate the contract by giving the contractor a thirty (30) day written notice of its intention to terminate without penalty or any further obligations on the part of NCISD or the contractor. Upon termination of the contract, NCISD shall not be responsible for any payment of any service or product received that occurs after the end of the current contract period or the effective date of termination, whichever is the earlier to occur.

d. Insurance. Contractor must obtain and keep in effect during the term of the contract, insurance coverage in the below listed types and minimum amounts. As evidence of insurance coverage, **Contractor must furnish to NCISD certificate(s) of insurance as detailed in Exhibit A to the AIA Document A 101-2017 (see Section A. 3.1.1)**.

Type of Coverage	Amount of Coverage
Liability and other insurance	As detailed in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD
Workers Compensation & Employers Liability Insurance	As detailed in Exhibit A hereto and Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD

Contractor must perform the duties and responsibilities pertaining to required workers' compensation coverages, as detailed in Exhibit A and in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD.

Contractor shall provide NCISD with a certificate of coverage for each person providing services on the project, prior to that person's beginning work on the project. This provision 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 contracts directly with the contractor and regardless of whether that person has employees. This includes, but is not limited to, independent contractors, subcontractors, leasing companies, motor carriers, owner-operators, employees of any such entity, or employees of any entity furnishing persons to perform services on the contract. Services include, but are not limited to, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other services related to a project. Services do not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

Contractor shall provide NCISD with a new certificate of coverage showing extension of coverage:

(1) Before the end of the coverage period, if the contractor's current certificate shows that the coverage period ends during the duration of the project; and
(2) No later than seven days after the expiration of the coverage for each other person providing services on the project whose current certificate shows that the coverage period ends during the duration of the project.

e. Performance and Payment Bonds. The successful contractor, before beginning the work under any contract resulting from this procurement solicitation, is required to execute a performance bond and a payment bond as detailed in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD (enclosed herein as Exhibit C).

Proposers must provide, with their proposals, a letter of statement from a bonding company that the proposer general contractor is eligible to obtain both payment and performance bonds of the types described in this procurement solicitation.

f. Prevailing Wage Rates. A worker, laborer, or mechanic employed on a public work by or on behalf of NCISD 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.

The NCISD Board has determined the general prevailing rate of per diem wages in the locality in which the public work is to be performed for each craft or type of worker needed to execute the contract and the prevailing rate for legal holiday and overtime work. Attached hereto as Exhibit B are the prevailing wage rates adopted by the NCISD Board.

The contractor who is awarded a public works contract by NCISD or a subcontractor of the contractor shall pay not less than the prevailing wage rates determined by NCISD to a worker employed by it in the execution of the public works contract. A contractor or subcontractor who violates the requirement to pay prevailing wage rates shall pay to NCISD, $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 public works contract; NCISD shall specify this penalty in the public works contract.

Obligation to keep Prevailing Wage Rates Records. A contractor and subcontractor employed on an NCISD public works contract shall keep a record showing:

(1) the name and occupation of each worker employed by the contractor or subcontractor in the construction of the public work; and
(2) the actual per diem wages paid to each worker.

The record shall be open at all reasonable hours to inspection by NCISD officers and agents. Tex. Gov't Code § 2258.024.

g. Permitting; Inspections. Contractor and all subcontractors shall maintain all required licenses, certifications, permits, and any other documentation necessary to perform the contract resulting from this procurement solicitation. Contractor must comply with all state and local building code requirements.

h. Safety Record of Proposer. NCISD will consider the safety record of the proposer in determining to whom to award a contract resulting from this procurement solicitation. The safety record shall be defined as a proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years, a loss analysis from the proposer's insurance carrier, and a loss history covering all lines of insurance coverage carried by the proposer. *See* NCISD Policy CVB (Local).

Proposers shall submit with their proposals:

a. Proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years,
b. a loss analysis from the proposer's insurance carrier, and
c. a loss history covering all lines of insurance coverage carried by the proposer.

i. Conflict of Interest. NCISD is required to comply with Texas Local Government Code Chapter 176, Disclosure of Certain Relationships with Local Government Officers. House Bill 23 significantly changed Chapter 176 as well as the required disclosures and the corresponding forms. As of September 1, 2015, any company who does business with NCISD or who seeks to do business with NCISD must fill out the new Conflict of Interest Questionnaire (CIQ) whether or not a conflict of interest exists. *See* Attachment D – Proposer Certification Forms.

j. Discrepancies. Any discrepancies within the Construction Documents, including between the Drawings and Specifications, or errors must be reported to the architect for interpretation. The architect will at all times endeavor to explain and interpret all discrepancies, but does not bind itself for any interpretation not in writing. In the event of discrepancies which have not been interpreted in writing or conflicts within the Contract Documents, including drawings and specifications, the Proposer shall consider that the greater value or quantity shall apply and the submitted Competitive Sealed Proposal shall reflect this fact.

k. Materials. Any reference in the Construction Documents to materials, products, equipment, fixtures, etc., shall not be construed as limiting competition in any manner; however, only the architect/engineer shall have the authority to determine whether a material is equal. No substitution will be allowed unless authorized in writing by the architect or engineer. See below section regarding Substitutions.

Where a definite material is specified, it is to set a standard, unless so noted that NO substitution allowed. Manufacturers of products not named in the Construction Documents will be required to show evidence satisfactory to the architect/engineer, that their product is equal in construction, similar in design, and will serve the intended purpose as the item specifically named.

l. Substitutions. The materials, products and equipment described in the Construction Documents establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution. **No substitution will be considered prior to receipt of Proposals unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Proposals.** Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the Proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final. If the Architect approves a proposed substitution prior to receipt of Proposals,

such approval will be set forth in an Addendum. Proposer shall not rely upon approvals made in any other manner. No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

m. Appeal/Protest Process. Any Proposer who submitted a proposal may appeal NCISD's award, if the appeal is based on deviations from laws, rules, regulations, or NCISD Board policies. NCISD Board Policy GF (Local) applies to any Proposer wishing to appeal a proposal and/or award of a contract. In accordance with Policy GF (Local), a Proposer shall submit a complaint/appeal form by hand-delivery, fax, or U.S. mail, to NCISD's Executive Director of Operations. Complaints/appeals must be received by the close of business on or before the 15th NCISD business day after award of the contract. In the event Proposer is unsure about the award of the contract, it is the Proposer's responsibility to contact NCISD on the next business day after the award is announced and verify details concerning the award.

8. **Proposal Format**

All proposals must include the following:

1. Title Page
2. Table of Contents
3. Business Identification
4. Compliance with Procurement Documents
5. Evidence to be used for evaluation/selection criteria
6. All required documentation and attachments (see #9, below)

Documentation must be complete.

9. **Required Documentation and Attachments**

The documentation and attachments listed below are required to be included with the proposal. All forms must be completed and signed.

Include the following for the Base Proposal:

1. Proof of Insurance – certificates of insurance of the types and amounts described in this procurement solicitation, including in Exhibit A and in Exhibit A to the AIA Document A101-2017, Insurance and Bonds, as modified by NCISD (enclosed as Exhibit C hereto)
2. Letter of statement from a bonding company that the proposer is eligible to obtain both payment and performance bonds of the types described in this procurement solicitation
3. Proposal security – Proposal security shall be submitted with each proposal in the amount of ten percent (10%) of the proposed amount
4. A list of the following proposed subcontractors for the Project:
    1) Concrete
    2) Masonry
    3) Structural Steel
    4) Cold-formed Metal Framing & Gypsum Board Assemblies
    5) Roofing
    6) Fire Suppression
    7) Plumbing
    8) HVAC
    9) Electrical
    10) Communications
    11) Electronic Access Control System
    12) Video Surveillance System
    13) Fire Detection and Alarm
    14) Earthwork
    15) Synthetic Turf System

17) Utilities

5. Proof of Proposer's Safety Record – Proposers must submit:
   a. Proposer's OSHA (Occupational Safety and Health Administration) inspection logs for the last three years,
   b. a loss analysis from the proposer's insurance carrier, and
   c. a loss history covering all lines of insurance coverage carried by the proposer.
6. Attachment A – Proposal Form – Base Proposal and Certification of Proposer; Alternate Proposals
7. Attachment B – Proposer Questionnaire and Qualification Statement
8. Attachment C – Proposer Certification Forms
9. Attachment D – Asbestos-Free Materials and Inspection
10. Attachment E – Acknowledgement of Final Completion Documents
11. Attachment F – W-9 Form
12. Attachment G – Criminal History Certification Form

10. **Documents to be submitted PRIOR to Proposal**

Each Proposer must submit the following items to the office of the Architect no later than **5:00 p.m. on January 22, 2025**:

a. A properly executed and current Contractor's Qualification Statement, AIA Document A305, and Contractor's references with the names of contact persons, telephone numbers and email addresses on the form included as **Attachment 1**;
b. A resume for the Proposer's proposed Project Manager, stating his/her qualifications and experience on projects of similar scope and size; and
c. A resume for the Proposer's proposed Project Superintendent, stating his/her qualifications and experience on projects of similar scope and size.

Exhibit A – NCISD's Required Workers' Compensation Insurance Coverages

NCISD shall use the following language for bid specifications and contracts for building or construction, without any additional words or changes, except those required to accommodate the specific document in which they are contained or to impose stricter standards of documentation.

A copy of a certificate of insurance, a certificate of authority to self-insure issued by the Texas Department of Insurance (TDI), or a coverage agreement (DWC-81, DWC-82, DWC-83, or DWC-84), showing statutory workers' compensation insurance coverage for the person's or entity's employees providing services on a project is required for the duration of the project.

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.

Persons providing services on the project ("subcontractor" in Texas Labor Code 406.096) include 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 contracted directly with the contractor and 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, or employees of any entity that furnishes persons to provide services on the project.

Services include, without limitation, providing, hauling, or delivering equipment or materials, or providing labor, transportation, or other service related to a project. Services do not include activities unrelated to the project, such as food/beverage vendors, office supply deliveries, and delivery of portable toilets.

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 401.011(44) for all employees of the contractor providing services on the project for the duration of the project.

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

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.

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 project, 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.

The contractor shall retain all required certificates of coverage for the duration of the project and for one year thereafter.

The contractor shall notify the governmental entity in writing by certified mail or personal delivery, within ten 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.

The contractor shall post on each project site a notice, in the text, form, and manner prescribed by the TDI, 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 of coverage.

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 meets the statutory requirements of Texas Labor Code 401.011(44) for all of its employees providing services on the project for the duration of the project;

2. Provide to 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, 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.

4. Obtain from each other person with whom it contracts, and provide to the contractor:

    a. A certificate of coverage, prior to the other person beginning work on the project; and
    b. A 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 ten 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 items 1–6, with the certificates of coverage to be provided to the person for whom they are providing services.

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 TDI's Division of Self-Insurance Regulation. Providing false or misleading information may subject the contractor to administrative penalties, criminal penalties, civil penalties, or other civil actions.

The contractor's failure to comply with any of these provisions is a breach of contract by the contractor that 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.

The coverage requirement recited above does not apply to sole proprietors, partners, and corporate officers who are excluded from coverage in an insurance policy or certificate of authority to self-insure that is delivered, issued for delivery, or renewed on or after January 1, 1996.

Exhibit B – Prevailing Wage Rates

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:

take cognizance of complaints of all violations of this chapter committed in the execution of the contract; and

(1) 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.

Prevailing Wage Rates – School Construction Trades

June 1, 2022 – Texas Gulf Coast Area

CLASSIFICATION	2022 HOURLY RATE
ASBESTOS WORKER	$21.13
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	$26.65
ELECTRICIAN	$25.93
ELEVATOR MECHANIC	$28.80
FIREPROOFING INSTALLER	$22.25
GLAZIER	$22.30
HEAVY EQUIPMENT OPERATOR	$22.40
INSULATOR	$20.50
IRONWORKER	$25.50
LABORER, HELPER	$16.71
LATHERER; PLASTERER	$23.25
LIGHT EQUIPMENT OPERATOR	$20.50
METAL BUILDING ASSEMBLER	$21.10
MILLWRIGHT	$33.63
PAINTER; WALL COVERING INSTALLER	$19.60
PIPEFITTER	$26.97
PLUMBER	$26.71
ROOFER	$20.50
SHEET METAL WORKER	$19.90
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.

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.

Exhibit C – AIA Documents A101-2017, Exhibit A to the AIA Document A101-2017, Insurance and Bonds; and A201-2017, all as amended by NCISD

See Separate Exhibit C, attached

Attachment 1 – Contractor References

Project: New Caney Independent School District's
New Caney High School Extracurricular Improvements-Phase III
Project #: 001-2023

General Contractor Name: _________________________________

***Submit with AIA A305 These Projects are to have been completed with-in the last 5 years.**

Project Name:	
Description:	Completion Date:
Contract Amount: $	Square Footage:
OWNER	**ARCHITECT**
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: $	Square Footage:
OWNER	**ARCHITECT**
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: $	Square Footage:
OWNER	**ARCHITECT**
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: $	Square Footage:
OWNER	**ARCHITECT**
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

Project Name:	
Description:	Completion Date:
Contract Amount: $	Square Footage:
OWNER	**ARCHITECT**
Contact Name:	Contact Name:
Phone Number:	Phone Number:
Email Address:	Email Address:

ATTACHMENT A: PROPOSAL FORM - BASE PROPOSAL

PROJECT TITLE: **New Caney Independent School District's-New Caney High School Extracurricular Improvements-Phase III**
Location: 22555 Eagle Drive. New Caney, TX. 77357

Name of Proposer/Contractor: _____
Address: _____ _____
Telephone: _____
Fax: _____
E-mail: _____

Receipt of Addenda: _____ _____

Total Proposal Amount Base Proposal:	_____ (amount written)	$_____
Unit Pricing No. 1:	120V duplex receptacle on nearest capable circuit.	$_____
Unit Pricing No. 2:	120V duplex receptacle on dedicated circuit, including each 20-amp circuit breaker and 200 feet of pathway to Panelboard.	$_____
Unit Pricing No. 3:	Single data drop, flush mounted in wall j-box with each 1-1/4", terminated at wall and patch panel, labeled, tested, conduit stubbed up wall to above ceiling and 200 feet of cabling.	$_____
Unit Pricing No. 4:	1,000 square yards of bermudagrass sod on each prepared topsoil, with maintenance, including watering, for three months past substantial completion.	$_____
Unit Pricing No. 5:	1,000 square yards of bermudagrass hydromulch on each prepared topsoil, with maintenance, including watering, for three months past substantial completion.	$_____
Unit Pricing No. 6:	Cubic yard of excavation of dirt or caliche, each excluding trucking off site.	$_____
Unit Pricing No. 7:	Cubic yard of backfilling, meeting fill requirements each of construction documents, from off-site sources, compacted in lifts as required by construction documents.	$_____
Unit Pricing No. 8:	Cubic yard of concrete, including pumping, placement, and finishing.	$_____
Unit Pricing No. 9:	Additional Lime-Flyash treated subgrade. Square yard compacted in lifts as required by construction documents	$_____
Unit Pricing No. 10:	Casings for drilled piers, per linear foot.	$_____

The undersigned hereby proposes to furnish all labor, materials, supervision, and any other services necessary to complete the above-referenced project for the proposal amount(s) listed.

Proposal prices are firm for acceptance by NCISD for 60 days from the date opening of proposals has occurred.

Signed By: _____

Name: _____
(Type or Print)

Title: _____
(Type or Print)

ATTEST: _____
(Secretary, if Proposer is a Corporation)
SEAL:
(If Corporation)

PROPOSAL FORM - ALTERNATE PROPOSALS

PROJECT TITLE: **New Caney Independent School District's-New Caney High School Extracurricular Improvements-Phase III**

Location: 22555 Eagle Drive. New Caney, TX. 77357

Name of Proposer/Contractor: _____

Address: _____ _____

Telephone: _____

Fax: _____

E-mail: _____

Alternate No. 1A: Air Cooled Chillers by Carrier. Base Proposal: No Air Cooled Chillers.	_____ amount written (this governs)	$_____
Alternate No. 1B: Air Cooled Chillers by Trane. Base Proposal: No Air Cooled Chillers.	_____ amount written (this governs)	$_____
Alternate No. 1C: Air Cooled Chillers by JCI/York. Base Proposal: No Air Cooled Chillers.	_____ amount written (this governs)	$_____
Alternate No. 1D: Air Cooled Chillers by Daikin. Base Proposal: No Air Cooled Chillers.	_____ amount written (this governs)	$_____
Alternate No. 2A: Infilled Synthetic Turf System by Field Turf. Base Proposal: No Infilled Synthetic Turf System.	_____ amount written (this governs)	$_____
Alternate No. 2B: Infilled Synthetic Turf System by Hellas. Base Proposal: No Infilled Synthetic Turf System.	_____ amount written (this governs)	$_____
Alternate No. 2C: Infilled Synthetic Turf System by Paragon. Base Proposal: No Infilled Synthetic Turf System.	_____ amount written (this governs)	$_____
Alternate No. 2D: Infilled Synthetic Turf System with Full Fill Cooling System by Field Turf. Base Proposal: No Infilled Synthetic Turf System.	_____ amount written (this governs)	$_____

Alternate No. 2E: Infilled Synthetic Turf System with Full Fill Cooling System and Extra Innings for Batters/ Catchers/ Umpire Areas by Hellas. Base Proposal: No Infilled Synthetic Turf System.	_____ amount written (this governs)	$_____
Alternate No. 2F: Infilled Synthetic Turf System with Full Fill Cooling System and Extra Innings for Batters/ Catchers/ Umpire Areas by Paragon. Base Proposal: No Infilled Synthetic Turf System.	_____ amount written (this governs)	$_____
Alternate No. 3A: Track System by Beynon. Base Proposal: No Infilled Track System.	_____ amount written (this governs)	$_____
Alternate No. 3B: Track System by Hellas. Base Proposal: No Infilled Track System.	_____ amount written (this governs)	$_____
Alternate No. 3C: Track System by Paragon. Base Proposal: No Infilled Track System.	_____ amount written (this governs)	$_____
Alternate No. 4: Lighting Controls	_____ amount written (this governs)	$_____
Alternate No. 5: Adjustment to Base Proposal. Base Proposal: No Adjustment to Base Proposal.	_____ amount written (this governs)	$_____

The undersigned hereby proposes to furnish all labor, materials, supervision and any other services necessary to complete the above-referenced project for the proposal amount(s) listed.

Proposal prices are firm for acceptance by NCISD for 60 days from the date opening of proposals has occurred.

Signed By: _____

Name: _____
(Type or Print)

Title: _____
(Type or Print)

ATTEST: _____
(Secretary, if Proposer is a Corporation)
SEAL:
(If Corporation)

CERTIFICATION OF PROPOSER

The undersigned Proposer has carefully examined all instructions, requirements, specifications, terms and conditions of this procurement solicitation and the construction documents and certifies:

1. It is a reputable company regularly engaged in providing construction services necessary to meet the requirements, specifications, terms and conditions of the procurement solicitation.
2. The Proposer has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Proposer's personal observations with the requirements of the proposed Contract Documents.
3. It has the necessary experience, knowledge, abilities, skills, and resources to satisfactorily perform the requirements, specifications, terms and conditions of this procurement solicitation. Further, if awarded, the Proposer agrees to perform the requirements, specifications, terms and conditions of this procurement solicitation and to obtain final completion for the entire project on or before November 2, 2026.
4. Proposer proposes to furnish all labor, materials, supervision and any other services necessary to complete the project for the proposal amount(s) listed on Attachment A. The Proposal is based upon the materials, equipment and systems required by the Procurement Documents without exception. The undersigned certifies that the amount(s) contained in Attachment A have been carefully checked and are submitted as correct and final.
5. All statements, information, and representations prepared and submitted in response to this procurement solicitation are current, complete, true, and accurate. Proposer acknowledges that NCISD will rely on such statements, information, and representations in selecting the successful proposer. Proposer shall be bound by all statements, representations, warranties, and guarantees made in its proposal.
6. It is not currently barred or suspended from doing business with the Federal government, any of the members represented, or any of their respective agencies.
7. That all of the requirements of this procurement solicitation and the construction documents have been read and understood, including any amendments/addenda. In addition, compliance with all requirements, terms and conditions will be assumed by NCISD if not otherwise noted in the proposal.
8. The individual signing below has authority to submit this proposal on behalf of Proposer.

PROJECT TITLE:	**NCISD – New Caney High School Extracurricular Improvements-Phase III**		
PROPOSER NAME:			
AUTHORIZED SIGNATURE:			
PRINT NAME:			
TITLE:			
DATE:			
ADDRESS:			
CITY, STATE, ZIP CODE:			
PHONE:		**FAX:**	
EMAIL ADDRESS:			
WEBSITE URL:			

ATTACHMENT B – BUSINESS QUESTIONNAIRE & QUALIFICATION STATEMENT

FIRM NAME: _____

CONTACT PERSON'S NAME AND PHONE NUMBER:

_____

Do you or any officer, partner, owner, sales representative, and/or spouse work for New Caney Independent School District? ☐ Yes ☐ No

If yes, please specify: _____

Please indicate how you became aware of this procurement.
Source: _____

I. ORGANIZATION

1. Type of Organization

_____ Individual _____ Sole Proprietorship
_____ Partnership _____ Corporation, Incorporated in _____

2. Federal Employer Identification Number: _____

3. Number of persons currently employed: _____

4. How many years has your organization been in business as a contractor? _____

5. How many years has your organization been in business under its present business name? _____

List any other or former names your organization has operated under:
_____

6. If your organization is a corporation, answer the following:

Date of incorporation: _____

State of incorporation: _____

President's name: _____

Vice-president's name: _____

7. If your organization is a partnership, answer the following:

Date of organization: _____

Type of partnership (if applicable): _____

Names(s) of general partner(s): _____

8. If your organization is individually owned, answer the following:

   Date of organization: _____

   Name of owner: _____

9. If the form of your organization is other than those listed above, describe it and name the principals/owners: _____

II. LICENSING

1. List the jurisdiction(s) and trade categories in which your organization is legally qualified to do business, and indicate registration or license numbers, if applicable.
   _____
   _____

2. List the jurisdiction(s) in which your organization's partnership or trade name is filed.
   _____

III. EXPERIENCE

1. List the categories of work that your organization normally performs with its own forces.
   _____
   _____

2. Claims and Suits: (If the answer to any of the questions below is yes, please attach details.)

   Has your organization ever failed to complete any work awarded to it?
   ☐ Yes ☐ No

   Are there any judgments, claims, arbitration proceedings or suits pending or outstanding against your organization or its officers? ☐ Yes ☐ No

   Has your organization filed any lawsuits or requested arbitration with regard to construction contracts within the last five years? ☐ Yes ☐ No

3. On a separate sheet, list major construction projects your organization has in progress, giving the name of the project, owner, architect, contract amount, percent complete, and scheduled completion date.

Personnel

4. Given the scope and schedule of the Project, identify key personnel who would work on the Project including the Project Manager, Superintendent, and Estimator. Provide a resume and references for each individual, including information on projects they have worked on that are similar to this RFP. What assurances can you provide that these team members will be available for project start?
5. Describe, in detail, the proposed Project assignments and lines of authority and communication for each team member you anticipate to be directly involved in the Project. Indicate the estimated percentage of time these team members will be involved in the Project.

6. Provide a description of your firm's home office location, satellite office locations, number and types of equipment available to support this Project.

IV. FINANCING

Name of Proposer's Financial Institution: _____

Contact Person: _____

Title: _____

1. Attach a financial statement, preferably audited, including your organization's latest balance sheet and income statement showing the following items:

    a. Current Assets (e.g., cash, joint venture accounts, accounts receivable, notes receivable, accrued income, deposits, materials inventory and prepaid expenses)
    b. Net Fixed Assets
    c. Other Assets
    d. Current Liabilities (e.g., accounts payable, notes payable, accrued expenses, provisions for income taxes, advances, accrued salaries and accrued payroll taxes)
    e. Other Liabilities (e.g., capital, capital stock, authorized and outstanding shares par values, earned surplus and retained earnings)

2. Name and address of firm/individual preparing attached financial statement, and date thereof:
    _____

3. Is the attached financial statement for the identical organization (proposer) named on page one?
    ☐ Yes ☐ No

    If no, explain the relationship and financial responsibility of the organization whose financial statement is provided (e.g., parent-subsidiary):
    _____

4. Will the organization whose financial statement is attached act as a guarantor of the contract for construction? ☐ Yes ☐ No

ATTACHMENT C – PROPOSER CERTIFICATION FORMS

CERTIFICATION OF RESIDENCY

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

Section: 2252.001: "Non-resident bidder" refers to a person who is not a resident. "Resident bidder" refers to a person whose principal place of business is in this state, including a vendor 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 non-resident bidder unless the nonresident underbids the lowest bid submitted by a 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."

Company submitting bid is a resident bidder: ☐ Yes ☐ No

City and state of vendor's principal place of business: _____

Contractor's Name/Company Name:

Address, City, State, and Zip Code: _____

Phone Number: _____ Fax Number: _____

Printed Name and Title of Authorized Representative: _____

Email Address: _____

Signature of Authorized Representative: _____

Date: _____

CERTIFICATION REGARDING TERRORIST ORGANIZATIONS

Vendor 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.

_____ Initials of Authorized Representative of Vendor

CERTIFICATION REGARDING BOYCOTTING OF ISRAEL

If (a) Vendor is not a sole proprietorship; (b) Vendor has ten (10) or more full-time employees; and (c) this Agreement has a value of $100,000 or more, the following certification shall apply; otherwise, this certification is not required. Pursuant to Chapter 2270 of the Texas Government Code, the Vendor hereby certifies and verifies that neither the Vendor, nor any affiliate, subsidiary, or parent company of the Vendor, if any (the "Vendor Companies"), boycotts Israel, and the Vendor agrees that the Vendor and Vendor Companies will not boycott Israel during the term of this Agreement. For purposes of this Agreement, the term "boycott" shall mean and include refusing to deal with, terminating business activities with, 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, but does not include an action made for ordinary business purposes.

_____ Initials of Authorized Representative of Vendor, if applicable

CERTIFICATION REGARDING CONTRACTING INFORMATION

If Vendor is not a governmental body and (a) this Agreement has a stated expenditure of at least $1 million in public funds for the purchase of goods or services by NCISD; or (b) this Agreement results in the expenditure of at least $1 million in public funds for the purchase of goods or services by NCISD in a fiscal year of NCISD, the following certification shall apply; otherwise, this certification is not required. As required by Tex. Gov't Code § 552.374(b), the following statement is included in the RFP and the Agreement (unless the Agreement is (1) related to the purchase or underwriting of a public security; (2) is or may be used as collateral on a loan; or (3) proceeds from which are used to pay debt service of a public security of loan): "The requirements of Subchapter J, Chapter 552, Government Code, may apply to this RFP and Agreement and the contractor or vendor agrees that the contract can be terminated if the contractor or vendor knowingly or intentionally fails to comply with a requirement of that subchapter." Pursuant to Subchapter J, Chapter 552, Texas Government Code, the Vendor hereby certifies and agrees to (1) preserve all contracting information related to this Agreement as provided by the records retention requirements applicable to NCISD for the duration of the Agreement; (2) promptly provide to NCISD any contracting information related to the Agreement that is in the custody or possession of the Vendor on request of NCISD; and (3) on completion of the Agreement, either (a) provide at no cost to NCISD all contracting information related to the Agreement that is in the custody or possession of Vendor, or (b) preserve the contracting information related to the Agreement as provided by the records retention requirements applicable to NCISD.

_____ Initials of Authorized Representative of Vendor, if applicable

Vendor agrees to comply with all federal, state, and local laws, rules, regulations and ordinances, as applicable. It is further acknowledged that vendor certifies compliance with all provisions, laws, acts, regulations, etc. as specifically noted above.

Vendor's Name/Company Name: _____
Address, City, State, and Zip Code: _____
Phone Number: _____ Fax Number: _____
Printed Name and Title of Authorized Representative: _____
Email Address: _____
Signature of Authorized Representative: _____
Date: _____

NCISD CONFLICT OF INTEREST DISCLOSURE STATEMENT

New Caney Independent School District (NCISD) is required to comply with Texas Local Government Code Chapter 176, Disclosure of Certain Relationships with Local Government Officers. House Bill 23 significantly changed Chapter 176 as well as the required disclosures and the corresponding forms. As of September 1, 2015, any vendor who does business with NCISD or who seeks to do business with NCISD must fill out the new Conflict of Interest Questionnaire (CIQ) whether or not a conflict of interest exists. A conflict of interest exists in the following situations:

1) If the vendor has an employment or other business relationship with a local government officer of NCISD or a family member of the officer, as described by section 176.003(a)(2)(A) of the Texas Local Government Code; or
2) If the vendor has given a local government officer of NCISD, or a family member of the officer, one or more gifts with the aggregate value of $100, excluding any gift accepted by the officer or a family member of the officer if the gift is: (a) a political contribution as defined by Title 15 of the Election Code; or (b) a gift of food accepted as a guest; or
3) If the vendor has a family relationship with a local government officer of NCISD.

"Vendor" means a person who enters or seeks to enter into a contract with a local governmental entity. The term includes an agent of a vendor. The term includes an officer or employee of a state agency when that individual is acting in a private capacity to enter into a contract. The term does not include a state agency except for Texas Correctional Industries. *Texas Local Government Code 176.001(7).*

"Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on: (A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity; (B) a transaction conducted at a price and subject to terms available to the public; or (C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency. *Texas Local Government Code 176.001(3).*

"Family relationship" means a relationship between a person and another person within the third degree by consanguinity or the second degree by affinity, as those terms are defined by Subchapter B, Chapter 573, Government Code. *Texas Local Government Code 176.001(2-a).*

"Local government officer" means: (A) a member of the governing body of a local governmental entity; (B) a director, superintendent, administrator, president, or other person designated as the executive officer of a local governmental entity; or (C) an agent of a local governmental entity who exercises discretion in the planning, recommending, selecting, or contracting of a vendor. *Texas Local Government Code 176.001(4).*

- ***NCISD Board of Trustees and Superintendent include:***

Creg Mixon, President	Chad Turner
Elizabeth Harrell, Vice-President	Ty Trout
Wendy Sharp, Secretary	Beth Prykryl
Angela Tompkins, Assistant Secretary	Matt Calvert, Superintendent

- ***Current local government officers include, but are not limited to:***

Brandy Chelette	Richard Ressler
Christie Gates	
Blake Carroll	

If no conflict of interest exists, you must fill out Box 1 and type N/A on Box 3 of the CIQ form, sign and date it. In the event of changed circumstances, an updated CIQ must be filed within seven (7) business days after the vendor becomes aware that a conflict of interest exists.

CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor 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 vendor becomes aware of facts that require the statement to be filed. *See* Section 176.006(a-1), Local Government Code.

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

OFFICE USE ONLY

Date Received

1 **Name of vendor who has a business relationship with local governmental entity.**

2 ☐ **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 on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

3 **Name of local government officer about whom the information is being disclosed.**

_____
Name of Officer

4 **Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

5 **Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

6 ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

7

_____ _____
Signature of vendor doing business with the governmental entity Date

CONFLICT OF INTEREST QUESTIONNAIRE
For vendor doing business with local governmental entity

A complete copy of Chapter 176 of the Local Government Code may be found at http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm. For easy reference, below are some of the sections cited on this form.

Local Government Code § 176.001(1-a): "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

(A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;

(B) a transaction conducted at a price and subject to terms available to the public; or

(C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

Local Government Code § 176.003(a)(2)(A) and (B):

(a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

***

(2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds $2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than $100 in the 12-month period preceding the date the officer becomes aware that:

(i) a contract between the local governmental entity and vendor has been executed; or

(ii) the local governmental entity is considering entering into a contract with the vendor.

Local Government Code § 176.006(a) and (a-1)

(a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

(a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

(1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

(2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

NCISD CERTIFICATE OF INTERESTED PARTIES – FORM 1295

NCISD is required to comply with HB 1295, which amended the Texas Government Code by adding Section 2252.908, Disclosure of Interested Parties. Section 2252.908 applies to a contract of NCISD that (1) requires an action or vote by the NCISD Board of Trustees before the contract may be signed; (2) has a value of at least $1 million; or (3) is for services that would require a person to register as a lobbyist under Tex. Gov't Code Chapter 305. If applicable, the business entity must submit a Disclosure of Interested Parties (Form 1295) to NCISD at the time business entity submits the signed contract. The Form 1295 requirement does not apply to: (1) a contract with a publicly traded business entity or wholly owned subsidiary of the same; (2) an electric utility; or (3) a gas utility. The Texas Ethics Commission has adopted rules requiring the business entity to file Form 1295 electronically with the Texas Ethics Commission. The following **definitions** apply:

(1) ***"Business Entity"*** means an entity recognized by law through which business is conducted, including a sole proprietorship, partnership, or corporation. TEX. GOV'T CODE § 2252.908(1).

(2) ***"Interested Party"*** means a person:
   a) who has a controlling interest in a business entity with whom NCISD 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. TEX. GOV'T CODE § 2252.908(3).

(3) ***"Controlling interest"*** means:
   a) an ownership interest or participating interest in a business entity by virtue of units, percentage, shares, stock, or otherwise that exceeds 10 percent;
   b) membership on the board of directors or other governing body of a business entity of which the board or other governing body is composed of not more than 10 members; or
   c) service as an officer of a business entity that has four or fewer officers, or service as one of the four officers most highly compensated by a business entity that has more than four officers. *Subsection (c) does not apply to an officer of a publicly held business entity or its wholly owned subsidiaries.* TEX. ETHICS COMM. RULE 46.3(c).

(4) ***"Intermediary"*** means a person who actively participates in the facilitation of the contract or negotiating the contract, including a broker, adviser, attorney, or representative of or agent for the business entity who:
   a) receives compensation from the business entity for the person's participation;
   b) communicates directly with the governmental entity or state agency on behalf of the business entity regarding the contract; and
   c) is not an employee of the business entity. TEX. ETHICS COMM. RULE 46.3(e).

As a "business entity," vendors must:

(1) **complete 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
- **All vendors must complete Form 1295, even if no interested parties exist**
- In Section 2, insert "New Caney Independent School District"
- In Section 3, insert the NCISD CSP # for this proposal

(2) **print a copy of the completed form** (make sure that it has a computer-generated certification number in the "Office Use Only" box)

(3) have an authorized agent of the business entity **sign the form**

(4) **submit** the completed Form 1295 by **attaching the form to your proposal.**

NCISD 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 receipt. After NCISD 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 NCISD.

FELONY CONVICTION NOTICE FORM

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 an agreement 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 the agreement 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".

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 information furnished is true to the best of my knowledge.

Contractor's Name/Company Name: _____

Authorized Official's Name (Printed or Typed): _____

You must select one and sign below:

☐ Firm is a publicly held corporation; therefore the above reporting requirement does not apply per Section 44.034, Texas Education Code, Subsection (c).

☐ Contractor/Firm **is not** owned nor operated by anyone who has been convicted of a felony.

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

Name of Individual(s): _____ Detail of Conviction(s): _____ *(Attach additional pages if necessary.)*

Signature of Company Official: _____

Date: _____

CONFIDENTIALITY DECLARATION FORM

INFORMATION SUBMITTED TO NCISD IN CONNECTION WITH THIS PROCUREMENT SOLICITATION OR THE AGREEMENT IS GOVERNED BY TEXAS GOVERNMENT CODE, CHAPTER 552

As a governmental body, NCISD is subject to the Texas Public Information Act found in Chapter 552, Texas Government Code. Proposals and other information submitted to NCISD in connection with this procurement solicitation or the Agreement may be subject to release as public information. If a Vendor believes that part(s) of its proposal or any other information submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement contain confidential, proprietary, and/or trade secret information or otherwise may be excepted from disclosure under Texas law, the Vendor must clearly and conspicuously mark the applicable information as "CONFIDENTIAL."

Marking information as "CONFIDENTIAL" does not guarantee that the information will be withheld from disclosure. If NCISD receives a request for public information involving information that Vendor has clearly and conspicuously marked as "CONFIDENTIAL," NCISD will respond pursuant to Chapter 552, Texas Government Code, which may or may not require that NCISD provide notice of the request to Vendor. Vendor understands and agrees that it is solely responsible for submitting to the Attorney General of Texas each reason why the requested information should be withheld and a letter, memorandum, or brief in support of that reason. NCISD assumes no obligation or responsibility relating to the disclosure or nondisclosure of information submitted by Vendors, and **Vendor hereby waives any claim against and releases from liability NCISD, its respective officers, employees, agents, and attorneys with respect to disclosure of information provided under or in connection with this procurement solicitation or the Agreement or otherwise created, assembled, maintained, or held by Vendor or NCISD and determined by NCISD, the Attorney General of Texas, or a court of law to be subject to disclosure under the Texas Public Information Act**. Further, even if Vendor marks information as "CONFIDENTIAL," **Vendor expressly agrees that NCISD may disclose Vendor's proposal, including, but not limited to, pricing information, to other governmental entities.**

Please check **ONLY ONE** of the following options:

- ☐ **Declaration of Confidentiality – Vendor HAS clearly and conspicuously marked information contained in its proposal and/or other information submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement as "CONFIDENTIAL." Vendor declares that the information marked by Vendor as "CONFIDENTIAL" contains confidential, proprietary, and/or trade secret information and is excepted from disclosure under Chapter 552, Texas Government Code.**

- ☐ **Waiver of Confidentiality – Vendor HAS NOT marked any information contained in its proposal and/or other information submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement as "CONFIDENTIAL." Vendor certifies that it has not submitted any confidential, proprietary, and/or trade secret information to NCISD and that its proposal and all other information—including any pricing information—submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement is subject to disclosure under Chapter 552, Texas Government Code. Vendor hereby expressly waives any claim of confidentiality with respect to its proposal and/or any other information—including any pricing information—submitted by Vendor to NCISD in connection with this procurement solicitation or the Agreement.**

_____
Vendor Name

_____ _____
Printed Name of Authorized Officer/Representative of Vendor **Title**

_____ _____
Signature **Date**

ATTACHMENT D – ASBESTOS-FREE MATERIALS AND INSPECTION

If awarded the project, the Contractor shall be responsible for ensuring that no asbestos containing building materials are used in the construction. The Contractor shall take whatever measures it deems necessary to ensure that all employees, suppliers, fabricators, and subcontractors, comply with this requirement.

At Final Completion the Contractor shall provide a certification letter certifying that the work does not contain asbestos containing building materials.

I hereby certify that I have read, understood and agree to the terms mentioned in this document.

Signature:_____

Printed Name & Title: _____

Company Name: _____

Date: _____

ATTACHMENT E – ACKNOWLEDGEMENT OF FINAL COMPLETION DOCUMENTS

If awarded this project, the General Contractor shall provide the following items at the project's final completion stage. The retainage shall not be released until all of the items have been fulfilled.

1. Completion of all discrepancies (punch list items) noted at the time of Substantial Completion
2. Submission of record drawings and specifications, and other record documents as required by contract documents.
3. Completion of all Owner training
4. Submission of all contractually-required attic stock and spare parts
5. Submission of all final Operation & Maintenance documents and other closeout deliverables
6. Submission of consent of surety to release retainage and final payment application.
7. Submission and approval of all remaining change order proposals, claims, and applications for payment
8. Payment of all costs incurred for equipment, material, labor and services against the Project
9. Submission of Asbestos Free Materials certification letter and certifications for lead and PCB's.
10. No liens have been attached against the project
11. No suits are pending by reason of Work on the Project Under the Contract for Construction
12. All workers' compensation claims are covered by Workers' Compensation Insurance as required by law
13. All insurance required of the Contractor beyond final payment, if any, is in effect and will not be cancelled or allowed to be expired without notice to the owner
14. All public liability claims are adequately covered by insurance and that the builder shall save, protect, defend, indemnify, and hold the Owner harmless from and against any and all claims which arise as direct or indirect result of any transaction, event occurrence, or omission related to performance of the work completed under said Contract for Construction
15. All Work and Material Warranties Provided.
16. Unconditional Final Payment Release and Waiver Document Provided.
17. All inspections by governmental authorities having jurisdiction over the project must have been finalized and any remedial work required by those authorities must also be completed. .
18. Certificate of Occupancy Provided.

I hereby certify that I have acknowledged and agree to provide the items listed in this document during the final completion stage if I were to be awarded with this project.

Signature: _____

Printed Name & Title: _____

Company Name: _____

Date: _____

ATTACHMENT F – W-9 FORM

Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

► Go to *www.irs.gov/FormW9* for instructions and the latest information.

Give Form to the requester. Do not send to the IRS.

Print or type. See Specific Instructions on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ► _____

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ►

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) _____

Exemption from FATCA reporting code (if any) _____

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN,* later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			–			–				

or

Employer identification number

		–							

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here **Signature of U.S. person** ► **Date** ►

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9.*

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

Cat. No. 10231X Form **W-9** (Rev. 10-2018)

By signing the filled-out form, you:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),

2. Certify that you are not subject to backup withholding, or

3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and

4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct. See *What is FATCA reporting,* later, for further information.

Note: If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien;
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States;
- An estate (other than a foreign estate); or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

In the cases below, the following person must give Form W-9 to the partnership for purposes of establishing its U.S. status and avoiding withholding on its allocable share of net income from the partnership conducting a trade or business in the United States.

- In the case of a disregarded entity with a U.S. owner, the U.S. owner of the disregarded entity and not the entity;
- In the case of a grantor trust with a U.S. grantor or other U.S. owner, generally, the U.S. grantor or other U.S. owner of the grantor trust and not the trust; and
- In the case of a U.S. trust (other than a grantor trust), the U.S. trust (other than a grantor trust) and not the beneficiaries of the trust.

Foreign person. If you are a foreign person or the U.S. branch of a foreign bank that has elected to be treated as a U.S. person, do not use Form W-9. Instead, use the appropriate Form W-8 or Form 8233 (see Pub. 515, Withholding of Tax on Nonresident Aliens and Foreign Entities).

Nonresident alien who becomes a resident alien. Generally, only a nonresident alien individual may use the terms of a tax treaty to reduce or eliminate U.S. tax on certain types of income. However, most tax treaties contain a provision known as a "saving clause." Exceptions specified in the saving clause may permit an exemption from tax to continue for certain types of income even after the payee has otherwise become a U.S. resident alien for tax purposes.

If you are a U.S. resident alien who is relying on an exception contained in the saving clause of a tax treaty to claim an exemption from U.S. tax on certain types of income, you must attach a statement to Form W-9 that specifies the following five items.

1. The treaty country. Generally, this must be the same treaty under which you claimed exemption from tax as a nonresident alien.

2. The treaty article addressing the income.

3. The article number (or location) in the tax treaty that contains the saving clause and its exceptions.

4. The type and amount of income that qualifies for the exemption from tax.

5. Sufficient facts to justify the exemption from tax under the terms of the treaty article.

Example. Article 20 of the U.S.-China income tax treaty allows an exemption from tax for scholarship income received by a Chinese student temporarily present in the United States. Under U.S. law, this student will become a resident alien for tax purposes if his or her stay in the United States exceeds 5 calendar years. However, paragraph 2 of the first Protocol to the U.S.-China treaty (dated April 30, 1984) allows the provisions of Article 20 to continue to apply even after the Chinese student becomes a resident alien of the United States. A Chinese student who qualifies for this exception (under paragraph 2 of the first protocol) and is relying on this exception to claim an exemption from tax on his or her scholarship or fellowship income would attach to Form W-9 a statement that includes the information described above to support that exemption.

If you are a nonresident alien or a foreign entity, give the requester the appropriate completed Form W-8 or Form 8233.

Backup Withholding

What is backup withholding? Persons making certain payments to you must under certain conditions withhold and pay to the IRS 24% of such payments. This is called "backup withholding." Payments that may be subject to backup withholding include interest, tax-exempt interest, dividends, broker and barter exchange transactions, rents, royalties, nonemployee pay, payments made in settlement of payment card and third party network transactions, and certain payments from fishing boat operators. Real estate transactions are not subject to backup withholding.

You will not be subject to backup withholding on payments you receive if you give the requester your correct TIN, make the proper certifications, and report all your taxable interest and dividends on your tax return.

Payments you receive will be subject to backup withholding if:

1. You do not furnish your TIN to the requester,

2. You do not certify your TIN when required (see the instructions for Part II for details),

3. The IRS tells the requester that you furnished an incorrect TIN,

4. The IRS tells you that you are subject to backup withholding because you did not report all your interest and dividends on your tax return (for reportable interest and dividends only), or

5. You do not certify to the requester that you are not subject to backup withholding under 4 above (for reportable interest and dividend accounts opened after 1983 only).

Certain payees and payments are exempt from backup withholding. See *Exempt payee code,* later, and the separate Instructions for the Requester of Form W-9 for more information.

Also see *Special rules for partnerships,* earlier.

What is FATCA Reporting?

The Foreign Account Tax Compliance Act (FATCA) requires a participating foreign financial institution to report all United States account holders that are specified United States persons. Certain payees are exempt from FATCA reporting. See *Exemption from FATCA reporting code,* later, and the Instructions for the Requester of Form W-9 for more information.

Updating Your Information

You must provide updated information to any person to whom you claimed to be an exempt payee if you are no longer an exempt payee and anticipate receiving reportable payments in the future from this person. For example, you may need to provide updated information if you are a C corporation that elects to be an S corporation, or if you no longer are tax exempt. In addition, you must furnish a new Form W-9 if the name or TIN changes for the account; for example, if the grantor of a grantor trust dies.

Penalties

Failure to furnish TIN. If you fail to furnish your correct TIN to a requester, you are subject to a penalty of $50 for each such failure unless your failure is due to reasonable cause and not to willful neglect.

Civil penalty for false information with respect to withholding. If you make a false statement with no reasonable basis that results in no backup withholding, you are subject to a $500 penalty.

Criminal penalty for falsifying information. Willfully falsifying certifications or affirmations may subject you to criminal penalties including fines and/or imprisonment.

Misuse of TINs. If the requester discloses or uses TINs in violation of federal law, the requester may be subject to civil and criminal penalties.

Specific Instructions

Line 1

You must enter one of the following on this line; **do not** leave this line blank. The name should match the name on your tax return.

If this Form W-9 is for a joint account (other than an account maintained by a foreign financial institution (FFI)), list first, and then circle, the name of the person or entity whose number you entered in Part I of Form W-9. If you are providing Form W-9 to an FFI to document a joint account, each holder of the account that is a U.S. person must provide a Form W-9.

a. **Individual.** Generally, enter the name shown on your tax return. If you have changed your last name without informing the Social Security Administration (SSA) of the name change, enter your first name, the last name as shown on your social security card, and your new last name.

Note: ITIN applicant: Enter your individual name as it was entered on your Form W-7 application, line 1a. This should also be the same as the name you entered on the Form 1040/1040A/1040EZ you filed with your application.

b. **Sole proprietor or single-member LLC.** Enter your individual name as shown on your 1040/1040A/1040EZ on line 1. You may enter your business, trade, or "doing business as" (DBA) name on line 2.

c. **Partnership, LLC that is not a single-member LLC, C corporation, or S corporation.** Enter the entity's name as shown on the entity's tax return on line 1 and any business, trade, or DBA name on line 2.

d. **Other entities.** Enter your name as shown on required U.S. federal tax documents on line 1. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on line 2.

e. **Disregarded entity.** For U.S. federal tax purposes, an entity that is disregarded as an entity separate from its owner is treated as a "disregarded entity." See Regulations section 301.7701-2(c)(2)(iii). Enter the owner's name on line 1. The name of the entity entered on line 1 should never be a disregarded entity. The name on line 1 should be the name shown on the income tax return on which the income should be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a single owner that is a U.S. person, the U.S. owner's name is required to be provided on line 1. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on line 2, "Business name/disregarded entity name." If the owner of the disregarded entity is a foreign person, the owner must complete an appropriate Form W-8 instead of a Form W-9. This is the case even if the foreign person has a U.S. TIN.

Line 2

If you have a business name, trade name, DBA name, or disregarded entity name, you may enter it on line 2.

Line 3

Check the appropriate box on line 3 for the U.S. federal tax classification of the person whose name is entered on line 1. Check only one box on line 3.

IF the entity/person on line 1 is a(n) . . .	THEN check the box for . . .
• Corporation	Corporation
• Individual • Sole proprietorship, or • Single-member limited liability company (LLC) owned by an individual and disregarded for U.S. federal tax purposes.	Individual/sole proprietor or single-member LLC
• LLC treated as a partnership for U.S. federal tax purposes, • LLC that has filed Form 8832 or 2553 to be taxed as a corporation, or • LLC that is disregarded as an entity separate from its owner but the owner is another LLC that is not disregarded for U.S. federal tax purposes.	Limited liability company and enter the appropriate tax classification. (P= Partnership; C= C corporation; or S= S corporation)
• Partnership	Partnership
• Trust/estate	Trust/estate

Line 4, Exemptions

If you are exempt from backup withholding and/or FATCA reporting, enter in the appropriate space on line 4 any code(s) that may apply to you.

Exempt payee code.

- Generally, individuals (including sole proprietors) are not exempt from backup withholding.
- Except as provided below, corporations are exempt from backup withholding for certain payments, including interest and dividends.
- Corporations are not exempt from backup withholding for payments made in settlement of payment card or third party network transactions.
- Corporations are not exempt from backup withholding with respect to attorneys' fees or gross proceeds paid to attorneys, and corporations that provide medical or health care services are not exempt with respect to payments reportable on Form 1099-MISC.

The following codes identify payees that are exempt from backup withholding. Enter the appropriate code in the space in line 4.

1—An organization exempt from tax under section 501(a), any IRA, or a custodial account under section 403(b)(7) if the account satisfies the requirements of section 401(f)(2)

2—The United States or any of its agencies or instrumentalities

3—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

4—A foreign government or any of its political subdivisions, agencies, or instrumentalities

5—A corporation

6—A dealer in securities or commodities required to register in the United States, the District of Columbia, or a U.S. commonwealth or possession

7—A futures commission merchant registered with the Commodity Futures Trading Commission

8—A real estate investment trust

9—An entity registered at all times during the tax year under the Investment Company Act of 1940

10—A common trust fund operated by a bank under section 584(a)

11—A financial institution

12—A middleman known in the investment community as a nominee or custodian

13—A trust exempt from tax under section 664 or described in section 4947

The following chart shows types of payments that may be exempt from backup withholding. The chart applies to the exempt payees listed above, 1 through 13.

IF the payment is for . . .	THEN the payment is exempt for . . .
Interest and dividend payments	All exempt payees except for 7
Broker transactions	Exempt payees 1 through 4 and 6 through 11 and all C corporations. S corporations must not enter an exempt payee code because they are exempt only for sales of noncovered securities acquired prior to 2012.
Barter exchange transactions and patronage dividends	Exempt payees 1 through 4
Payments over $600 required to be reported and direct sales over $5,000[1]	Generally, exempt payees 1 through 5[2]
Payments made in settlement of payment card or third party network transactions	Exempt payees 1 through 4

[1] See Form 1099-MISC, Miscellaneous Income, and its instructions.

[2] However, the following payments made to a corporation and reportable on Form 1099-MISC are not exempt from backup withholding: medical and health care payments, attorneys' fees, gross proceeds paid to an attorney reportable under section 6045(f), and payments for services paid by a federal executive agency.

Exemption from FATCA reporting code. The following codes identify payees that are exempt from reporting under FATCA. These codes apply to persons submitting this form for accounts maintained outside of the United States by certain foreign financial institutions. Therefore, if you are only submitting this form for an account you hold in the United States, you may leave this field blank. Consult with the person requesting this form if you are uncertain if the financial institution is subject to these requirements. A requester may indicate that a code is not required by providing you with a Form W-9 with "Not Applicable" (or any similar indication) written or printed on the line for a FATCA exemption code.

A—An organization exempt from tax under section 501(a) or any individual retirement plan as defined in section 7701(a)(37)

B—The United States or any of its agencies or instrumentalities

C—A state, the District of Columbia, a U.S. commonwealth or possession, or any of their political subdivisions or instrumentalities

D—A corporation the stock of which is regularly traded on one or more established securities markets, as described in Regulations section 1.1472-1(c)(1)(i)

E—A corporation that is a member of the same expanded affiliated group as a corporation described in Regulations section 1.1472-1(c)(1)(i)

F—A dealer in securities, commodities, or derivative financial instruments (including notional principal contracts, futures, forwards, and options) that is registered as such under the laws of the United States or any state

G—A real estate investment trust

H—A regulated investment company as defined in section 851 or an entity registered at all times during the tax year under the Investment Company Act of 1940

I—A common trust fund as defined in section 584(a)

J—A bank as defined in section 581

K—A broker

L—A trust exempt from tax under section 664 or described in section 4947(a)(1)

M—A tax exempt trust under a section 403(b) plan or section 457(g) plan

Note: You may wish to consult with the financial institution requesting this form to determine whether the FATCA code and/or exempt payee code should be completed.

Line 5

Enter your address (number, street, and apartment or suite number). This is where the requester of this Form W-9 will mail your information returns. If this address differs from the one the requester already has on file, write NEW at the top. If a new address is provided, there is still a chance the old address will be used until the payor changes your address in their records.

Line 6

Enter your city, state, and ZIP code.

Part I. Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. If you are a resident alien and you do not have and are not eligible to get an SSN, your TIN is your IRS individual taxpayer identification number (ITIN). Enter it in the social security number box. If you do not have an ITIN, see *How to get a TIN* below.

If you are a sole proprietor and you have an EIN, you may enter either your SSN or EIN.

If you are a single-member LLC that is disregarded as an entity separate from its owner, enter the owner's SSN (or EIN, if the owner has one). Do not enter the disregarded entity's EIN. If the LLC is classified as a corporation or partnership, enter the entity's EIN.

Note: See *What Name and Number To Give the Requester,* later, for further clarification of name and TIN combinations.

How to get a TIN. If you do not have a TIN, apply for one immediately. To apply for an SSN, get Form SS-5, Application for a Social Security Card, from your local SSA office or get this form online at *www.SSA.gov*. You may also get this form by calling 1-800-772-1213. Use Form W-7, Application for IRS Individual Taxpayer Identification Number, to apply for an ITIN, or Form SS-4, Application for Employer Identification Number, to apply for an EIN. You can apply for an EIN online by accessing the IRS website at *www.irs.gov/Businesses* and clicking on Employer Identification Number (EIN) under Starting a Business. Go to *www.irs.gov/Forms* to view, download, or print Form W-7 and/or Form SS-4. Or, you can go to *www.irs.gov/OrderForms* to place an order and have Form W-7 and/or SS-4 mailed to you within 10 business days.

If you are asked to complete Form W-9 but do not have a TIN, apply for a TIN and write "Applied For" in the space for the TIN, sign and date the form, and give it to the requester. For interest and dividend payments, and certain payments made with respect to readily tradable instruments, generally you will have 60 days to get a TIN and give it to the requester before you are subject to backup withholding on payments. The 60-day rule does not apply to other types of payments. You will be subject to backup withholding on all such payments until you provide your TIN to the requester.

Note: Entering "Applied For" means that you have already applied for a TIN or that you intend to apply for one soon.

Caution: A disregarded U.S. entity that has a foreign owner must use the appropriate Form W-8.

Part II. Certification

To establish to the withholding agent that you are a U.S. person, or resident alien, sign Form W-9. You may be requested to sign by the withholding agent even if item 1, 4, or 5 below indicates otherwise.

For a joint account, only the person whose TIN is shown in Part I should sign (when required). In the case of a disregarded entity, the person identified on line 1 must sign. Exempt payees, see *Exempt payee code,* earlier.

Signature requirements. Complete the certification as indicated in items 1 through 5 below.

1. Interest, dividend, and barter exchange accounts opened before 1984 and broker accounts considered active during 1983. You must give your correct TIN, but you do not have to sign the certification.

2. Interest, dividend, broker, and barter exchange accounts opened after 1983 and broker accounts considered inactive during 1983. You must sign the certification or backup withholding will apply. If you are subject to backup withholding and you are merely providing your correct TIN to the requester, you must cross out item 2 in the certification before signing the form.

3. Real estate transactions. You must sign the certification. You may cross out item 2 of the certification.

4. Other payments. You must give your correct TIN, but you do not have to sign the certification unless you have been notified that you have previously given an incorrect TIN. "Other payments" include payments made in the course of the requester's trade or business for rents, royalties, goods (other than bills for merchandise), medical and health care services (including payments to corporations), payments to a nonemployee for services, payments made in settlement of payment card and third party network transactions, payments to certain fishing boat crew members and fishermen, and gross proceeds paid to attorneys (including payments to corporations).

5. Mortgage interest paid by you, acquisition or abandonment of secured property, cancellation of debt, qualified tuition program payments (under section 529), ABLE accounts (under section 529A), IRA, Coverdell ESA, Archer MSA or HSA contributions or distributions, and pension distributions. You must give your correct TIN, but you do not have to sign the certification.

What Name and Number To Give the Requester

For this type of account:	Give name and SSN of:
1. Individual	The individual
2. Two or more individuals (joint account) other than an account maintained by an FFI	The actual owner of the account or, if combined funds, the first individual on the account[1]
3. Two or more U.S. persons (joint account maintained by an FFI)	Each holder of the account
4. Custodial account of a minor (Uniform Gift to Minors Act)	The minor[2]
5. a. The usual revocable savings trust (grantor is also trustee) b. So-called trust account that is not a legal or valid trust under state law	The grantor-trustee[1] The actual owner[1]
6. Sole proprietorship or disregarded entity owned by an individual	The owner[3]
7. Grantor trust filing under Optional Form 1099 Filing Method 1 (see Regulations section 1.671-4(b)(2)(i)(A))	The grantor*
For this type of account:	**Give name and EIN of:**
8. Disregarded entity not owned by an individual	The owner
9. A valid trust, estate, or pension trust	Legal entity[4]
10. Corporation or LLC electing corporate status on Form 8832 or Form 2553	The corporation
11. Association, club, religious, charitable, educational, or other tax-exempt organization	The organization
12. Partnership or multi-member LLC	The partnership
13. A broker or registered nominee	The broker or nominee
14. Account with the Department of Agriculture in the name of a public entity (such as a state or local government, school district, or prison) that receives agricultural program payments	The public entity
15. Grantor trust filing under the Form 1041 Filing Method or the Optional Form 1099 Filing Method 2 (see Regulations section 1.671-4(b)(2)(i)(B))	The trust

[1] List first and circle the name of the person whose number you furnish. If only one person on a joint account has an SSN, that person's number must be furnished.

[2] Circle the minor's name and furnish the minor's SSN.

[3] You must show your individual name and you may also enter your business or DBA name on the "Business name/disregarded entity" name line. You may use either your SSN or EIN (if you have one), but the IRS encourages you to use your SSN.

[4] List first and circle the name of the trust, estate, or pension trust. (Do not furnish the TIN of the personal representative or trustee unless the legal entity itself is not designated in the account title.) Also see *Special rules for partnerships,* earlier.

***Note:** The grantor also must provide a Form W-9 to trustee of trust.

Note: If no name is circled when more than one name is listed, the number will be considered to be that of the first name listed.

Secure Your Tax Records From Identity Theft

Identity theft occurs when someone uses your personal information such as your name, SSN, or other identifying information, without your permission, to commit fraud or other crimes. An identity thief may use your SSN to get a job or may file a tax return using your SSN to receive a refund.

To reduce your risk:

- Protect your SSN,
- Ensure your employer is protecting your SSN, and
- Be careful when choosing a tax preparer.

If your tax records are affected by identity theft and you receive a notice from the IRS, respond right away to the name and phone number printed on the IRS notice or letter.

If your tax records are not currently affected by identity theft but you think you are at risk due to a lost or stolen purse or wallet, questionable credit card activity or credit report, contact the IRS Identity Theft Hotline at 1-800-908-4490 or submit Form 14039.

For more information, see Pub. 5027, Identity Theft Information for Taxpayers.

Victims of identity theft who are experiencing economic harm or a systemic problem, or are seeking help in resolving tax problems that have not been resolved through normal channels, may be eligible for Taxpayer Advocate Service (TAS) assistance. You can reach TAS by calling the TAS toll-free case intake line at 1-877-777-4778 or TTY/TDD 1-800-829-4059.

Protect yourself from suspicious emails or phishing schemes. Phishing is the creation and use of email and websites designed to mimic legitimate business emails and websites. The most common act is sending an email to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft.

The IRS does not initiate contacts with taxpayers via emails. Also, the IRS does not request personal detailed information through email or ask taxpayers for the PIN numbers, passwords, or similar secret access information for their credit card, bank, or other financial accounts.

If you receive an unsolicited email claiming to be from the IRS, forward this message to *phishing@irs.gov.* You may also report misuse of the IRS name, logo, or other IRS property to the Treasury Inspector General for Tax Administration (TIGTA) at 1-800-366-4484. You can forward suspicious emails to the Federal Trade Commission at *spam@uce.gov* or report them at *www.ftc.gov/complaint.* You can contact the FTC at *www.ftc.gov/idtheft* or 877-IDTHEFT (877-438-4338). If you have been the victim of identity theft, see *www.IdentityTheft.gov* and Pub. 5027.

Visit *www.irs.gov/IdentityTheft* to learn more about identity theft and how to reduce your risk.

Privacy Act Notice

Section 6109 of the Internal Revenue Code requires you to provide your correct TIN to persons (including federal agencies) who are required to file information returns with the IRS to report interest, dividends, or certain other income paid to you; mortgage interest you paid; the acquisition or abandonment of secured property; the cancellation of debt; or contributions you made to an IRA, Archer MSA, or HSA. The person collecting this form uses the information on the form to file information returns with the IRS, reporting the above information. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, the District of Columbia, and U.S. commonwealths and possessions for use in administering their laws. The information also may be disclosed to other countries under a treaty, to federal and state agencies to enforce civil and criminal laws, or to federal law enforcement and intelligence agencies to combat terrorism. You must provide your TIN whether or not you are required to file a tax return. Under section 3406, payers must generally withhold a percentage of taxable interest, dividend, and certain other payments to a payee who does not give a TIN to the payer. Certain penalties may also apply for providing false or fraudulent information.

Ch. 22 Criminal History Records Contractor Certification: Contractor/Subcontractor Employees

Background: Texas Education Code Chapter 22 requires that criminal history records be obtained regarding covered employees of entities that contract with a school district to provide services to the school district ("Contractors") and entities that contract with school district contractors ("Subcontractors"). Covered employees with disqualifying criminal histories are prohibited from serving at a school district. Contractors/Subcontractors shall (1) complete this form certifying compliance with the requirements of Texas Education Code Chapter 22 to NCISD; and (2) require that each of their subcontractors complies with the requirements of Texas Education Code Chapter 22.

Criminal history records will be obtained by either the Contractor/Subcontractor or NCISD, as follows:

(1) Contractor/Subcontractor: The only Contractors/Subcontractors who will be granted access to obtain criminal history record information are those "qualified school contractors" that (1) contract or subcontract to provide services to NCISD; and (2) are determined eligible by the Texas Department of Public Safety (DPS) to obtain criminal history record information under the National Child Protection Act of 1993 (34 U.S.C. § 40101 *et seq.*) (NCPA), specifically, those contractors/subcontractors who provide "care or care placement services" and are based in Texas, for an employee, applicant for employment, or volunteer of the "qualified school contractor." All "qualified school contractors" are required to obtain their covered employees' criminal histories, certify compliance to NCISD, and obtain similar certifications from their subcontractors. Before or immediately after employing or securing the services of a person who is a "covered employee" (as defined below) the Contractor/Subcontractor shall send or ensure that the employee sends to DPS all information that is required by DPS for obtaining the person's national criminal history record information, which may include (but is not limited to) a complete set of the person's fingerprints and a recent electronic digital image photograph of the person, as required by DPS. DPS shall obtain the person's national criminal history record information and report the results through the criminal history clearinghouse as provided by Texas Government Code 411.0845. For more information or to set up an account, Contractor/Subcontractor should contact the Texas Department of Public Safety's Crime Records Service at 512.424.2474. Contractor/Subcontractor shall obtain all criminal history record information that relates to all covered employees through the criminal history clearinghouse as provided by Texas Government Code 411.0845. In addition, Contractor/Subcontractor shall require that each of its subcontracting entities obtains all criminal history record information that relates to its covered employees, if the subcontracting entity is also a "qualified school contractor." Contractor/Subcontractor shall: (1) provide NCISD with a fitness determination (as set forth below) as to each covered employee, based on all criminal history record information obtained; and (2) certify to NCISD that Contractor/Subcontractor has received all criminal history record information relating to a person who is employed by or under a current offer of employment by Contractor/Subcontractor.

(2) NCISD: All Contractors/Subcontractors who are not "qualified school contractors" (in other words, all Contractors/Subcontractors who do not provide "care or care placement services" or are not based in Texas) are required to follow the instructions listed below, so that NCISD may obtain their covered employees' criminal history record information, as applicable. Contractor/Subcontractor shall also require that any of its subcontracting entities that are not "qualified school contractors" follow the instructions listed below, so that NCISD may obtain their covered employees' criminal history record information. **Contractor/Subcontractor is responsible for the payment of all fingerprinting costs. Should NCISD pay any costs of fingerprinting Contractor/Subcontractor employees, Contractor agrees to reimburse NCISD for such costs; in the event Contractor fails to reimburse NCISD for the costs of fingerprinting Contractor/Subcontractor employees, Contractor agrees that NCISD may deduct such costs from any payment due and owing by NCISD to Contractor.**

Definitions:

- Covered employees: Employees of a Contractor/Subcontractor who have or will have continuing duties related to the service to be performed at a school district and have or will have direct contact with students. NCISD will be the final arbiter of what constitutes *continuing duties* and *direct contact* with students.

- Continuing duties related to contracted services: Work duties that are performed pursuant to a contract to provide services to a school entity on a regular, repeated basis rather than infrequently or one-time only. *See* 19 Tex. Admin. Code §153.1101(2).

- Direct contact with students: The contact that results from activities that provide substantial opportunity for verbal or physical interaction with students that is not supervised by a certified educator or other professional district employee. Contact with students that results from services that do not provide substantial opportunity for unsupervised interaction with a student or students, such as addressing an assembly, officiating a sports contest, or judging an extracurricular event, is not, by itself, direct contact with students. However, direct contact with students does result from any activity that provides substantial opportunity for unsupervised contact with students, which might include, without limitation, the provision of coaching, tutoring, or other services to students. *See* 19 Tex. Admin. Code § 153.1101(7).

- Public Works Contractor: An entity that contracts directly or subcontracts with an entity that contracts with a school district to provide construction services to the school district.

- Exception for Certain Public Works Contractors' Employees and Applicants: The criminal history record information requirements outlined above do not apply to an employee or applicant for employment of a public works contractor (as defined above) if: (1) the public work does not involve the construction, alteration, or repair of an instructional facility as defined by Texas Education Code Section 46.001; (2) the employee's duties will be completed not later than the seventh (7th) day before a new instructional facility will be used for instruction; or (3) for an existing instructional facility, the work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence at least six (6) feet high, and the Contractor adopts, informs employees of, and enforces a policy prohibiting employees and any subcontractor's employees from interacting with students or entering areas used by students.

Disqualifying criminal history:

- (1) a conviction or other criminal history information designated by NCISD; or (2) a felony or misdemeanor offense that would prevent a person from being employed under Texas Education Code § 22.085(a), that is: (a) conviction of a felony offense under Title 5, Texas Penal Code if at the time of the offense, the victim was under 18; (b) conviction of or placement on deferred adjudication community supervision for an offense for which a defendant is required to register as a sex offender under Chapter 62, Texas Code of Criminal Procedure; or (c) conviction of an offense under federal law or the laws of another state that is equivalent to (a) or (b).

Types of Criminal History Record Information:

- National criminal history record information from the Texas Department of Public Safety criminal history clearinghouse. NCISD and/or Contractor/Subcontractor may obtain from any law enforcement or criminal justice agency all criminal history record information that relates to a covered employee.

On behalf of___("Contractor/Subcontractor"), I, the undersigned authorized signatory for Contractor/Subcontractor, certify to New Caney Independent School District ("NCISD") (and, in the case of a Subcontractor, certify to Contractor and NCISD) that [**check one**]:

[ ] **OPTION A: Contractor/Subcontractor certifies that none of the employees of Contractor/Subcontractor are *covered employees*, as defined above.** For each covered employee who is employed by or under a current offer of employment by Contractor/Subcontractor, Contractor/Subcontractor certifies to NCISD that it will timely complete the "Contractor Criminal History Background Check Certification" form and submit such to NCISD. If this box is checked, I further certify that Contractor/Subcontractor has taken precautions or imposed conditions to ensure that its employees will not become *covered employees*. Contractor/Subcontractor will ensure that these precautions or conditions continue to exist throughout the time that the contracted services are provided. If NCISD, in its sole discretion, determines that employees of Contractor/Subcontractor are *covered employees*, as defined above, Contractor/Subcontractor will provide NCISD with the name, date of birth, and any other requested information of such covered employees so that NCISD may obtain criminal history record information on the covered employees, upon request by NCISD.

Or

[ ] **OPTION B: Contractor/Subcontractor certifies that some or all of the employees of Contractor/Subcontractor are *covered employees*, but the criminal history record information requirements do not apply to its employees or applicants for employment because:**

(1) Contractor/Subcontractor is a public works contractor (an entity that contracts directly or subcontracts with an entity that contracts with a school district to provide construction services to the school district); **and**

(2) the public work does not involve the construction, alteration, or repair of an instructional facility as defined by Texas Education Code Section 46.001; the employee's duties will be completed not later than the seventh (7th) day before a new instructional facility will be used for instruction; **or** for an existing instructional facility, the work area contains sanitary facilities and is separated from all areas used by students by a secure barrier fence at least six (6) feet high, and the Contractor adopts, informs employees of, and enforces a policy prohibiting employees and any subcontractor's employees from interacting with students or entering areas used by students.

If this option is selected, Contractor/Subcontractor further certifies to NCISD that:

(a) Contractor/Subcontractor shall ensure that the conditions or precautions that resulted in the determination that the criminal history record information requirements do not apply to its employees or applicants for employment continue to exist throughout the time that the contracted services are provided;
(b) For each covered employee who is employed by or under a current offer of employment by Contractor/Subcontractor, Contractor/Subcontractor will timely complete the "Contractor Criminal History Background Check Certification" form and submit such to NCISD; and
(c) If NCISD, in its sole discretion, determines that the conditions in paragraph (1) and/or (2) above are not satisfied as to Contractor/Subcontractor, Contractor/Subcontractor will provide NCISD with the name, date of birth, and any other requested information of its covered employees so that NCISD may obtain criminal history record information on the covered employees, upon request by NCISD.

Or

[ ] **OPTION C: Contractor/Subcontractor certifies that some or all of the employees of Contractor/Subcontractor are *covered employees*, and Contractor/ Subcontractor is a "qualified school contractor."** For each covered employee who is employed by or under a current offer of employment by Contractor/Subcontractor, Contractor/Subcontractor certifies to NCISD that it will timely complete the "Contractor Criminal History Background Check Certification" form and submit such to NCISD. If this option is selected, I further certify that:

(1) Contractor/Subcontractor certifies to NCISD that Contractor/Subcontractor has received all criminal history record information relating to a person who is employed by or under a current offer of employment by Contractor/Subcontractor. Contractor/Subcontractor provides NCISD with the following fitness determination as to each covered employee, based on all criminal history record information obtained: None of the covered employees has a disqualifying criminal history.
(2) If Contractor/Subcontractor at any time receives information that a covered employee subsequently has a reported disqualifying criminal history, Contractor/Subcontractor will immediately remove the covered employee from contract duties and notify NCISD in writing within 3 business days.
(3) Upon request by NCISD, Contractor/Subcontractor will provide NCISD with the name, date of birth, and any other requested information of covered employees so that NCISD may obtain criminal history record information on the covered employees.

Or

[ ] **OPTION D: Contractor/Subcontractor certifies that some or all of the employees of Contractor/Subcontractor are *covered employees*, and Contractor/Subcontractor is not a "qualified school contractor."** If this option is selected, I further certify that:

(1) For each covered employee **who is employed by or under a current offer of employment by Contractor/Subcontractor**, **Contractor/Subcontractor certifies to NCISD that will timely complete the "Contractor Criminal History Background Check Certification" form and submit such to NCISD**, providing the following information regarding each covered employee as required by DPS in order to provide criminal history record information, so that NCISD may obtain the covered employees' criminal history record information: (a) Full name (first, middle, and last); (b) Date of birth; (c) Sex; (d) Social Security number; (e) number assigned to any form of unexpired identification card issued by Texas or another state, the District of Columbia, or a U.S. territory that includes the person's photograph; (f) if the employee has ever been fingerprinted by a public school district in Texas (and if so, the name of the school district); and (g) the person's written consent to the release of his or her criminal history record information.

(2) Contractor/Subcontractor shall provide NCISD's "Texas Fingerprint Service Code Form" document to all covered employees and ensure that they schedule fingerprinting appointments in a timely manner. Contractor/Subcontractor shall be solely responsible to send or ensure that each covered employee sends to

DPS all information that may be required by DPS for obtaining national criminal history record information, which may include, but is not limited to, a complete set of the person's fingerprints and a recent electronic digital image photograph of the person. Any covered employee whose criminal history record information is not received by NCISD at least ten (10) NCISD business days prior to the start of the services to be performed by Contractor/Subcontractor at NCISD is subject to exclusion from service, in NCISD's sole discretion, until his or her criminal history record information can be obtained and reviewed by NCISD. **Contractor/Subcontractor is responsible for the payment of all fingerprinting costs.** Because Contractor/Subcontractor is not a "qualified school contractor," it will not be permitted to view the criminal history record information obtained by NCISD.

(3) DPS shall obtain the person's national criminal history record information and report the results through the criminal history clearinghouse as provided by Texas Government Code 411.0845. Contractor/Subcontractor agrees that NCISD will obtain all criminal history record information that relates to a covered employee through the criminal history clearinghouse as provided by Texas Government Code 411.0845. Contractor/Subcontractor agrees that NCISD will review each covered employee's criminal history record information, together with the employee's qualifications, background, and experience, based on information gathered by NCISD through the procurement and/or contracting processes, to determine, in NCISD's sole discretion, whether any covered employee(s) should be prohibited from serving at NCISD. NCISD will notify Contractor/Subcontractor of its determination.

(4) If NCISD at any time receives information that a covered employee subsequently has a reported disqualifying criminal history or should be prohibited from serving at NCISD, in NCISD's sole discretion, for any other reason, including, but not limited to, the employee's qualifications, background, and experience, based on information gathered by NCISD through the procurement and/or contracting processes, NCISD will notify Contractor/Subcontractor of its determination. Contractor/Subcontractor will immediately remove the covered employee from contract duties.

Upon contract award and/or initiation of PO/contract from NCISD, the winning proposer/Contractor shall complete NCISD's "Contractor Criminal History Background Check Certification" form, providing the following information regarding each covered employee as required by DPS in order to provide criminal history record information, so that NCISD may obtain the covered employees' criminal history record information: (a) Full name (first, middle, and last); (b) Date of birth; (c) Sex; (d) Social Security number; (e) number assigned to any form of unexpired identification card issued by Texas or another state, the District of Columbia, or a U.S. territory that includes the person's photograph; (f) if the employee has ever been fingerprinted by a public school district in Texas (and if so, the name of the school district); and (g) the person's written consent to the release of his or her criminal history record information. Contractor/Subcontractor shall be solely responsible to send or ensure that each covered employee sends to DPS all information that may be required by DPS for obtaining national criminal history record information, which may include, but is not limited to, a complete set of the person's fingerprints and a recent electronic digital image photograph of the person.

If, during the term of the contract with NCISD, Contractor/Subcontractor employs additional covered employees or assigns new covered employees to perform services at NCISD, Contractor shall immediately notify NCISD and provide NCISD with all of the information listed in the preceding paragraph as to each additional covered employee, so that NCISD may obtain the additional covered employees' criminal history record information. If, during the term of the contract with NCISD, Contractor/Subcontractor ceases to employ a covered employee in connection with an NCISD contract, whose information was previously provided to NCISD, Contractor/Subcontractor shall immediately notify NCISD of the same and provide NCISD with each former covered employee's (a) Full name (first, middle, and last); (b) Date of birth; (c) Sex; (d) Social Security number; and (e) number assigned to any form of unexpired identification card issued by Texas or another state, the District of Columbia, or a U.S. territory that includes the person's photograph, so that NCISD may unsubscribe from that individual's criminal history record.

If NCISD, in its sole discretion, objects to the assignment of a covered employee for any reason, including, but not limited to, on the basis of the covered employee's criminal history record information and/or insufficient qualifications, lack of experience, and the like, based on information gathered by NCISD through the procurement and/or contracting processes, Contractor/Subcontractor agrees to discontinue using that covered employee to provide services at NCISD.

I also certify to NCISD (and, in the case of a Subcontractor, certify to Contractor and NCISD) on behalf of Contractor/Subcontractor that Contractor/Subcontractor has required its subcontractors to comply with Texas Education Code, Chapter 22 and obtained certifications from its subcontractors of such compliance. Noncompliance or misrepresentation regarding this certification may be grounds for contract termination.

_____ _____ _____

Signature Title Date

DOCUMENT 00 31 32

GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 LOG OF BORINGS/CONTRACTOR RESPONSIBILITY

A. A copy of the locations and log of borings is bound herein.

B. Subsurface soil data derived from test borings are given only for the convenience of the Contractor, and neither the Owner nor the Architect assumes responsibility for the accuracy of or for the Contractor's interpretation of the data.

C. Contractor is responsible for any conclusions drawn from the boring data and is responsible for the work without extra compensation irrespective of whether or not the subsurface conditions encountered agree with the boring data.

1.2 REPORT

A. The full geotechnical report prepared by the Owner's independent geotechnical and testing laboratory is available in the Architect's office for inspection by the Contractor.

B. This geotechnical report is not a part of the Contract Documents.

END OF DOCUMENT

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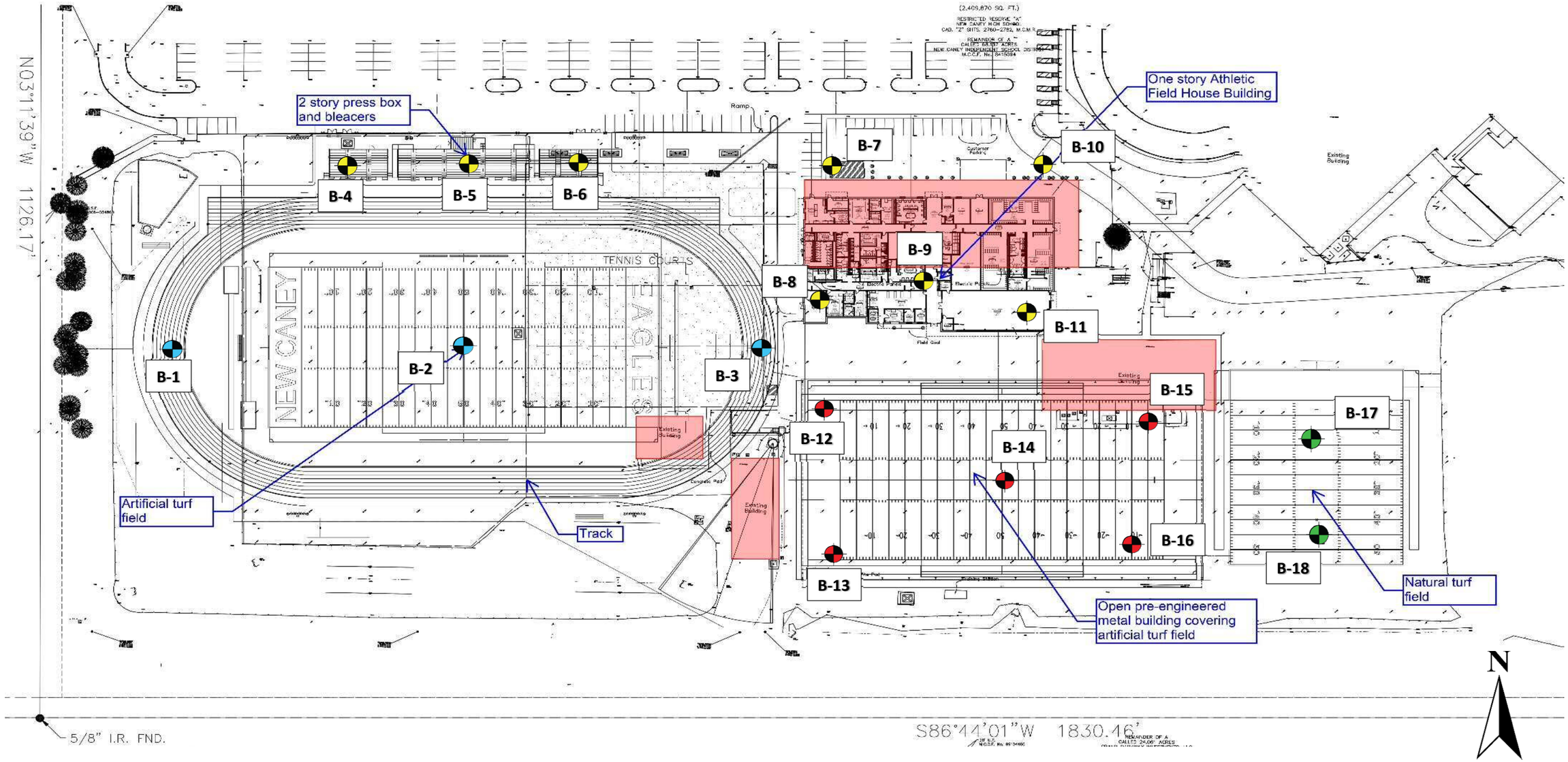
APPENDIX B

PLAN OF BORINGS



LEGEND

- Boreholes at 30'
- Boreholes at 25'
- Boreholes at 15'
- Boreholes at 10'

HTS CONSULTANTS

Proposed New Caney High School Phase 3

New Caney Independent School District
21650 TX-494 Loop
New Caney, Texas
HTS Project No.: 24-S-300

Boring Locations	Appendix B

APPENDIX C

BORING LOGS

LOG OF BORING B-01

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 15 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 101 feet
LATITUDE: 30° 7'53.55N
LONGITUDE: 95°13'32.36W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SILTY CLAY WITH SAND (CL-ML),** firm to stiff, brown and tan		71	18	13	5	15		119
5		CL		**SANDY LEAN CLAY (CL),** soft to very stiff, brown, reddish brown, gray and tan		67	26	14	12	17		
10												
15		SC		**CLAYEY SAND (SC),** brown, reddish brown, gray and tan		28	28	15	13	15		
20												
25												
30												

DEPTH OF BORING: 15 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

BORINGLOG_HOUSTON - HOUSTON TEMPLATE.GDT - 8/8/24 15:55 - H:\2024\300-349\24-S-300 21650 TX-494 LOOP - NEW CANEY ISD\BORING LOGS\24-300 LOGS.GPJ

HTS CONSULTANTS
416 Pickering Street
Houston, Texas 77091

PLATE NO: 1 (Page 1 of 1)

LOG OF BORING B-02

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 15 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'53.57N
LONGITUDE: 95°13'29.17W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** stiff, brown	10	55	18	13	5	14		
5		CL		**SANDY LEAN CLAY (CL),** soft to very stiff, brown, reddish brown and tan		67	28	15	13	16		117
						61				14		
10												
15												
20												
25												
30												

DEPTH OF BORING: 15 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

BORINGLOG_HOUSTON - HOUSTON TEMPLATE.GDT - 8/8/24 15:55 - H:\2024\300-349\24-S-300 21650 TX-494 LOOP - NEW CANEY ISD\BORING LOGS\24-300 LOGS.GPJ

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LOG OF BORING B-03

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 15 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 105 feet
LATITUDE: 30° 7'53.54N
LONGITUDE: 95°13'26.14W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		ML		**SANDY SILT (ML),** stiff, brown	11	62	16	13	3	11		
5		CL		**SANDY LEAN CLAY (CL),** soft, brown and reddish brown								
10		CL		**LEAN CLAY WITH SAND (CL),** firm to very stiff, brown, reddish brown and tan		73	27	15	12	19		111
15						70				17		
20												
25												
30												

DEPTH OF BORING: 15 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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PLATE NO: 3 (Page 1 of 1)

LOG OF BORING B-04

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'55.20N
LONGITUDE: 95°13'30.49W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** stiff, brown	13							
5		CL		**SANDY LEAN CLAY (CL),** stiff to hard, brown, reddish brown, gray and tan		66	25	14	11	18		
15		CL		**LEAN CLAY WITH SAND (CL),** very stiff, brown, gray and tan		84				20		
25						82	40	18	22	18		111
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-05

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'55.21N
LONGITUDE: 95°13'29.26W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** stiff, brown	15	58	17	13	4	17		
5		CL		**SANDY LEAN CLAY (CL),** stiff to hard, brown, reddish brown, gray and tan		59	27	15	12	17		113
10						65	38	15	23	14		119
15		CL		**LEAN CLAY (CL),** very stiff to hard, brown, gray and tan								
20						89				20		107
25												
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-06

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'55.18N
LONGITUDE: 95°13'27.97W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		ML		**SANDY SILT (ML),** stiff, brown	14	53	16	13	3	19		
5		CL		**SANDY LEAN CLAY (CL),** firm to hard, brown, reddish brown and tan						18		109
						66	35	17	18	12		124
10		CH		**FAT CLAY (CH),** stiff to very stiff, brown, gray and tan								
						91	63	22	41	22		102
15												
20												
		SC		**CLAYEY SAND (SC),** medium dense, gray	29	48				19		
25												
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-07

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'55.04N
LONGITUDE: 95°13'25.48W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		ML		**SANDY SILT (ML),** stiff, brown	13	55	16	13	2	13		
5		CH		**SANDY FAT CLAY (CH),** soft to very stiff, brown, light brown and tan		62	52	20	32	17		111
10		CL		**LEAN CLAY WITH SAND (CL),** very stiff, light brown and tan		74	41	18	23	16		
15												
20		CH		**FAT CLAY (CH),** very stiff, light brown and tan		95				20		104
		SC		**CLAYEY SAND (SC),** medium dense, light gray	26							
25												
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/26/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-08

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'53.93N
LONGITUDE: 95°13'25.45W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		SC-SM		**SILTY CLAYEY SAND (SC-SM),** medium dense, brown and light brown	12	29	18	13	5	10		
5		CL		**LEAN CLAY WITH SAND (CL),** firm to very stiff, light brown and tan		76	25	15	10	18		112
15		SC		**CLAYEY SAND (SC),** brown, light brown, gray and tan		44	31	16	NP	17		118
25		CH		**FAT CLAY (CH),** very stiff, light brown and gray								
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-09

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'53.95N
LONGITUDE: 95°13'24.31W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** firm to stiff, brown, light brown and tan		54	19	14	5	15	● ○	117
5		CL		**SANDY LEAN CLAY (CL),** very stiff, light brown, gray and tan		59	44	19	25	15	⊕	
10		SC		**CLAYEY SAND (SC),** medium dense, light brown, gray, light gray and tan		23	27	14	13	12	▲ ⊕	116
15					21							
20		CH		**FAT CLAY (CH),** very stiff, light brown and tan	27	15				14	⊕	
25												
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/17/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-10

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 105 feet
LATITUDE: 30° 7'55.04N
LONGITUDE: 95°13'23.21W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○HP ●UC △TV ▲UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL		**SANDY LEAN CLAY (CL),** soft to firm, brown and tan		62	36	17	19	17	●	107
		SC		**CLAYEY SAND (SC),** medium dense, brown and tan	12							
5						34	22	14	8	15	⊕	
		CL		**LEAN CLAY WITH SAND (CL),** very stiff to hard, light brown and tan							⊕	
10											⊕	
											⊕	
		CH		**FAT CLAY (CH),** very stiff, light brown and tan		95	51	20	31	21	▲ ⊕	105
15												
											⊕	
20												
		SC		**CLAYEY SAND (SC),** medium dense, gray								
					27	29				12		
25												
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/26/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-11

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 105 feet
LATITUDE: 30° 7'53.76N
LONGITUDE: 95°13'23.29W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○HP ●UC △TV ▲UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** firm, brown and light brown								
5		CL		**SANDY LEAN CLAY (CL),** soft to very stiff, light brown and tan		56	26	14	12	17		
10		SC		**CLAYEY SAND (SC),** medium dense, light brown and tan	19	40	31	16	15	14		
15												
20		CH		**FAT CLAY (CH),** very stiff, light brown and tan	26	94	55	20	35	20		108
25												
30												

DEPTH OF BORING: 25 FEET
DATE DRILLED: 7/18/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-12

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 28 FEET, WET ROTARY THEREAFTER

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 105 feet
LATITUDE: 30° 7'52.95N
LONGITUDE: 95°13'25.41W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○HP ●UC △TV ▲UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** firm, brown, light brown and tan		53	20	13	7	15		115
5		CL		**SANDY LEAN CLAY (CL),** firm to very stiff, light brown and tan, with ferrous stains, 4 to 12 ft.		70	35	16	19	17		
10												
15		SP-SM		**POORLY GRADED SAND WITH SILT (SP-SM),** medium dense, light brown and tan	21							
20					23	10	NP	NP	NP	9		
		CH		**FAT CLAY WITH SAND (CH),** very stiff, light brown and tan		79	51	20	31	18		115
25			▽									
30												

DEPTH OF BORING: 30 FEET
DATE DRILLED: 7/18/24

INITIAL GROUND WATER: 27 FEET
FINAL GROUND WATER: PRECLUDED DUE TO WET ROTARY

NOTES: Water Level: 26' approximately 10 minutes after groundwater was initially encountered.

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LOG OF BORING B-13

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 30 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 105 feet
LATITUDE: 30° 7'51.61N
LONGITUDE: 95°13'25.32W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		SM		**SILTY SAND (SM),** brown		27	NP	NP	NP	11		
		CL		**SANDY LEAN CLAY (CL),** stiff to hard, light brown and tan								
5						58	43	19	24	18		108
10												
		SM		**SILTY SAND (SM),** medium dense to dense, light brown and tan	23	14	NP	NP	NP	13		
15												
					33							
20												
		CL		**LEAN CLAY WITH SAND (CL),** very stiff, brown, light brown and tan								
25												
30						72	43	18	25	18		115

DEPTH OF BORING: 30 FEET
DATE DRILLED: 7/18/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

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LOG OF BORING B-14

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 28 FEET, WET ROTARY THEREAFTER

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 104 feet
LATITUDE: 30° 7'52.28N
LONGITUDE: 95°13'23.49W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** stiff, brown	15	60	17	13	4	13		
5		CL		**SANDY LEAN CLAY (CL),** soft to very stiff, light brown and tan, with calcareous nodules, 4 to 6 ft.		69	41	18	23	15		118
10						70	38	17	21	14		112
15												
20												
25		SC		**CLAYEY SAND (SC),** medium dense to dense, light gray	42							
					29	22				14		
30												

DEPTH OF BORING: 30 FEET
DATE DRILLED: 7/29/24

INITIAL GROUND WATER: 28 FEET
FINAL GROUND WATER: PRECLUDED DUE TO WET ROTARY

NOTES: Water Level: 25' approximately 10 minutes after groundwater was initially encountered.

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Houston, Texas 77091

PLATE NO: 14 (Page 1 of 1)

LOG OF BORING B-15

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET, WET ROTARY THEREAFTER

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'53.02N
LONGITUDE: 95°13'21.73W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○HP ●UC △TV ▲UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** stiff, brown and tan	11	58	16	12	4	13		
5		CL		**SANDY LEAN CLAY (CL),** soft to very stiff, light brown and tan		66	28	15	13	17		125
10		CL		**LEAN CLAY WITH SAND (CL),** stiff to very stiff, light brown and tan		75	41	18	23	18		111
15												
20												
25		SC		**CLAYEY SAND (SC),** medium dense to dense, gray	25	28				12		
30					36							

DEPTH OF BORING: 30 FEET
DATE DRILLED: 7/29/24

INITIAL GROUND WATER: 27 FEET
FINAL GROUND WATER: PRECLUDED DUE TO WET ROTARY

NOTES: Water Level: 25' approximately 10 minutes after groundwater was initially encountered.

BORINGLOG_HOUSTON - HOUSTON TEMPLATE.GDT - 8/8/24 15:55 - H:\2024\300-349\24-S-300 21650 TX-494 LOOP - NEW CANEY ISD\BORING LOGS\24-300 LOGS.GPJ

HTS CONSULTANTS
416 Pickering Street
Houston, Texas 77091

PLATE NO: 15 (Page 1 of 1)

LOG OF BORING B-16

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 25 FEET, WET ROTARY THEREAFTER

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 106 feet
LATITUDE: 30° 7'51.78N
LONGITUDE: 95°13'21.98W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
0		CL-ML		**SANDY SILTY CLAY (CL-ML),** soft to stiff, brown and tan	10	65	18	13	5	14		
5						67	21	14	7	16		122
		CL		**LEAN CLAY WITH SAND (CL),** stiff to very stiff, light brown and tan								
10		CH		**FAT CLAY (CH),** very stiff, light brown and tan		87	59	21	38	22		
15												
20						89				20		109
		SC		**CLAYEY SAND (SC),** medium dense to dense, gray and light gray	18							
25												
					33							
30												

DEPTH OF BORING: 30 FEET
DATE DRILLED: 7/29/24

INITIAL GROUND WATER: 27 FEET
FINAL GROUND WATER: PRECLUDED DUE TO WET ROTARY

NOTES: Water Level: 26.4' approximately 10 minutes after groundwater was initially encountered.

BORINGLOG_HOUSTON - HOUSTON TEMPLATE.GDT - 8/8/24 15:55 - H:\2024\300-349\24-S-300 21650 TX-494 LOOP - NEW CANEY ISD\BORING LOGS\24-300 LOGS.GPJ

HTS CONSULTANTS
416 Pickering Street
Houston, Texas 77091

PLATE NO: 16 (Page 1 of 1)

LOG OF BORING B-17

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 10 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 104 feet
LATITUDE: 30° 7'52.75N
LONGITUDE: 95°13'20.25W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○ HP ● UC △ TV ▲ UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
		CL-ML		**SANDY SILTY CLAY (CL-ML),** stiff, brown and light brown	12	59	19	13	6	15		
5		CL		**LEAN CLAY WITH SAND (CL),** stiff to very stiff, light brown and tan		71	36	17	19	17		
10												
15												
20												
25												
30												

DEPTH OF BORING: 10 FEET
DATE DRILLED: 7/26/24

INITIAL GROUND WATER: NOT ENCOUNTERED
FINAL GROUND WATER: NOT ENCOUNTERED

NOTES: Boring elevations and coordinates are approximate values obtained from Google Earth.

BORINGLOG_HOUSTON - HOUSTON TEMPLATE.GDT - 8/8/24 15:55 - H:\2024\300-349\24-S-300 21650 TX-494 LOOP - NEW CANEY ISD\BORING LOGS\24-300 LOGS.GPJ

HTS CONSULTANTS
416 Pickering Street
Houston, Texas 77091

PLATE NO: 17 (Page 1 of 1)

LOG OF BORING B-18

PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
21650 TX-494 LOOP, NEW CANEY, TEXAS

TYPE OF BORING: DRY AUGER TO 10 FEET

HTS Project No.: 24-S-300

COORDINATE (X) OR EASTING:
COORDINATE (Y) OR NORTHING:
APPROXIMATE SURFACE ELEVATION: 104 feet
LATITUDE: 30° 7'51.85N
LONGITUDE: 95°13'20.23W

DEPTH, FT.	SOIL TYPE	USCS SYMBOL	SAMPLES	SOIL DESCRIPTION	N-BLOWS/FT.	% PASSING No. 200 SIEVE	LIQUID LIMIT (LL)	PLASTIC LIMIT (PL)	PLASTICITY INDEX (PI)	MOISTURE CONTENT (%)	SHEAR STRENGTH (tons/square foot) ○HP ●UC △TV ▲UU 0.0 0.5 1.0 1.5 2.0 2.5	DRY UNIT WEIGHT (pcf)
0		CL-ML		**SANDY SILTY CLAY (CL-ML),** very soft to stiff, brown and light brown	8	50	18	13	5	14		
5						52	20	14	6	19	●⊖	134
		CL		**LEAN CLAY WITH SAND (CL),** firm to stiff, light brown and tan							⊖ ⊖	
10												
15												
20												
25												
30												

DEPTH OF BORING: 10 FEET
DATE DRILLED: 7/29/24

INITIAL GROUND WATER: 3.4 FEET
FINAL GROUND WATER:

NOTES: Perched water was encountered at a depth of 3.4 feet during drilling.

BORINGLOG_HOUSTON - HOUSTON TEMPLATE.GDT - 8/8/24 15:55 - H:\2024\300-349\24-S-300 21650 TX-494 LOOP - NEW CANEY ISD\BORING LOGS\24-300 LOGS.GPJ

HTS CONSULTANTS
416 Pickering Street
Houston, Texas 77091

PLATE NO: 18 (Page 1 of 1)

APPENDIX D

SUBSURFACE PROFILE DIAGRAM

HTS, Inc. Consultants
416 Pickering Street
Houston, Tx 77091
Telephone: 713-692-8373
Fax: 713-692-8502

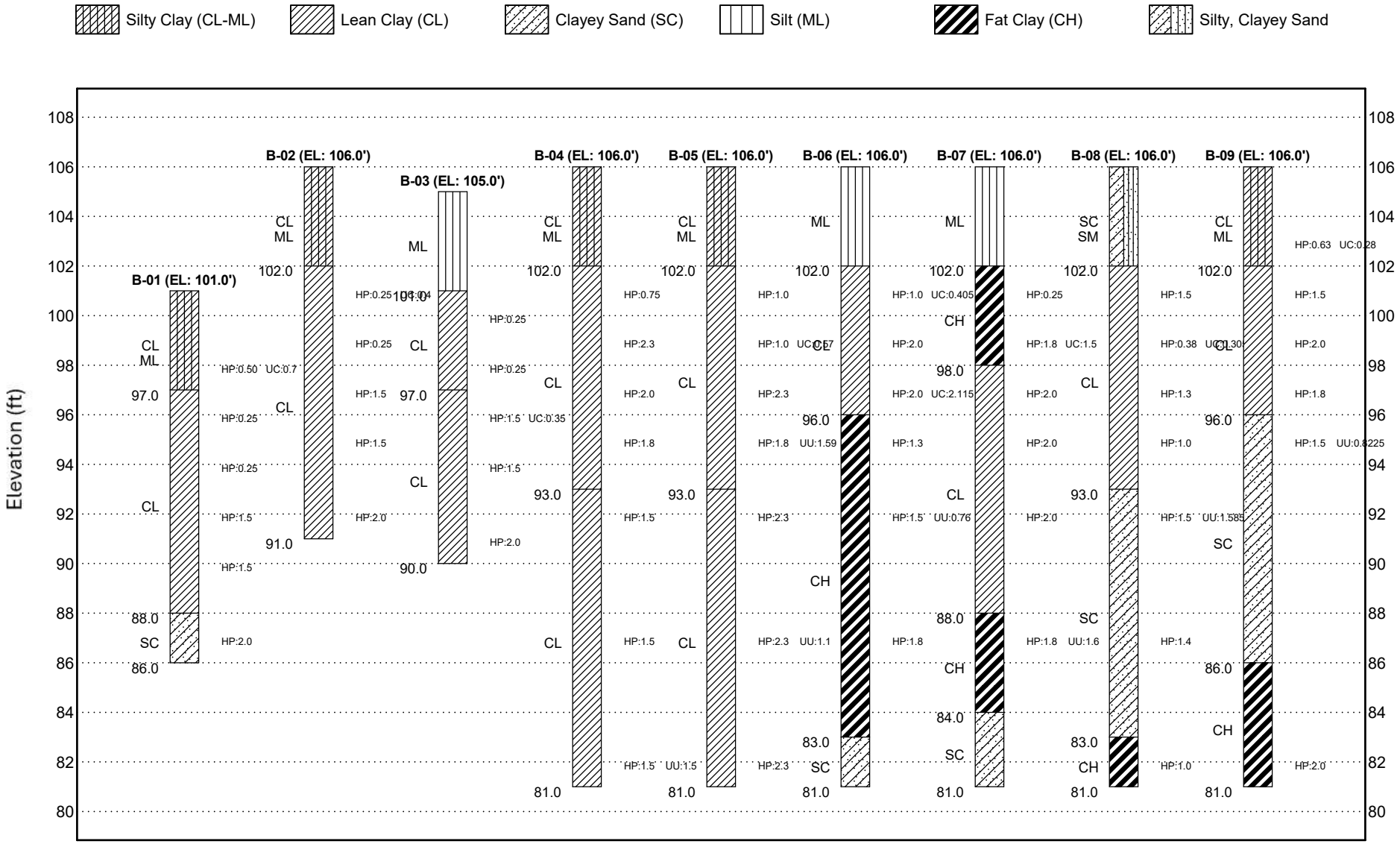
SUBSURFACE DIAGRAM

Appendix D

PROJECT NAME: PROPOSED NEW CANEY HIGH SCHOOL PHASE 3

PROJECT NUMBER: 24-S-300

PROJECT LOCATION: 21650 TX-494 LOOP, NEW CANEY, TEXAS



NOTE: BORING ELEVATIONS AND DISTANCE BETWEEEN BORINGS ARE APPROXIMATE VALUES OBTAINED FROM GOOGLE EARTH.

STRATIGRAPHY & GW - A SIZE - PSIHOUSTON.GDT - 8/8/24 12:09 - H:\2024\300-349\24-S-300 21650 TX-494 LOOP - NEW CANEY ISD\BORING LOGS\24-300 LOGS.GPJ

HTS, Inc. Consultants
416 Pickering Street
Houston, Tx 77091
Telephone: 713-692-8373
Fax: 713-692-8502

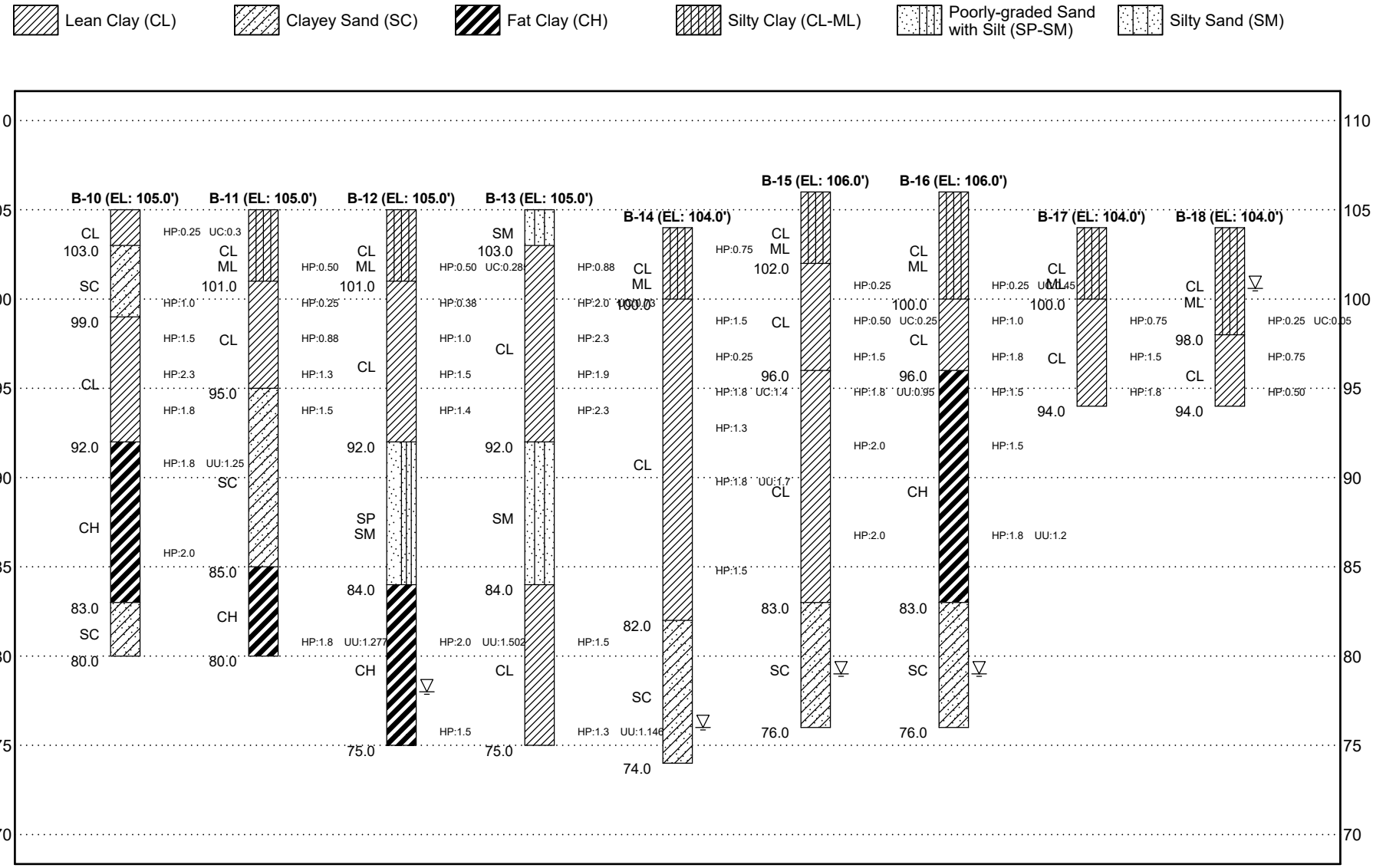
SUBSURFACE DIAGRAM

Appendix D

PROJECT NAME: PROPOSED NEW CANEY HIGH SCHOOL PHASE 3

PROJECT NUMBER: 24-S-300

PROJECT LOCATION: 21650 TX-494 LOOP, NEW CANEY, TEXAS

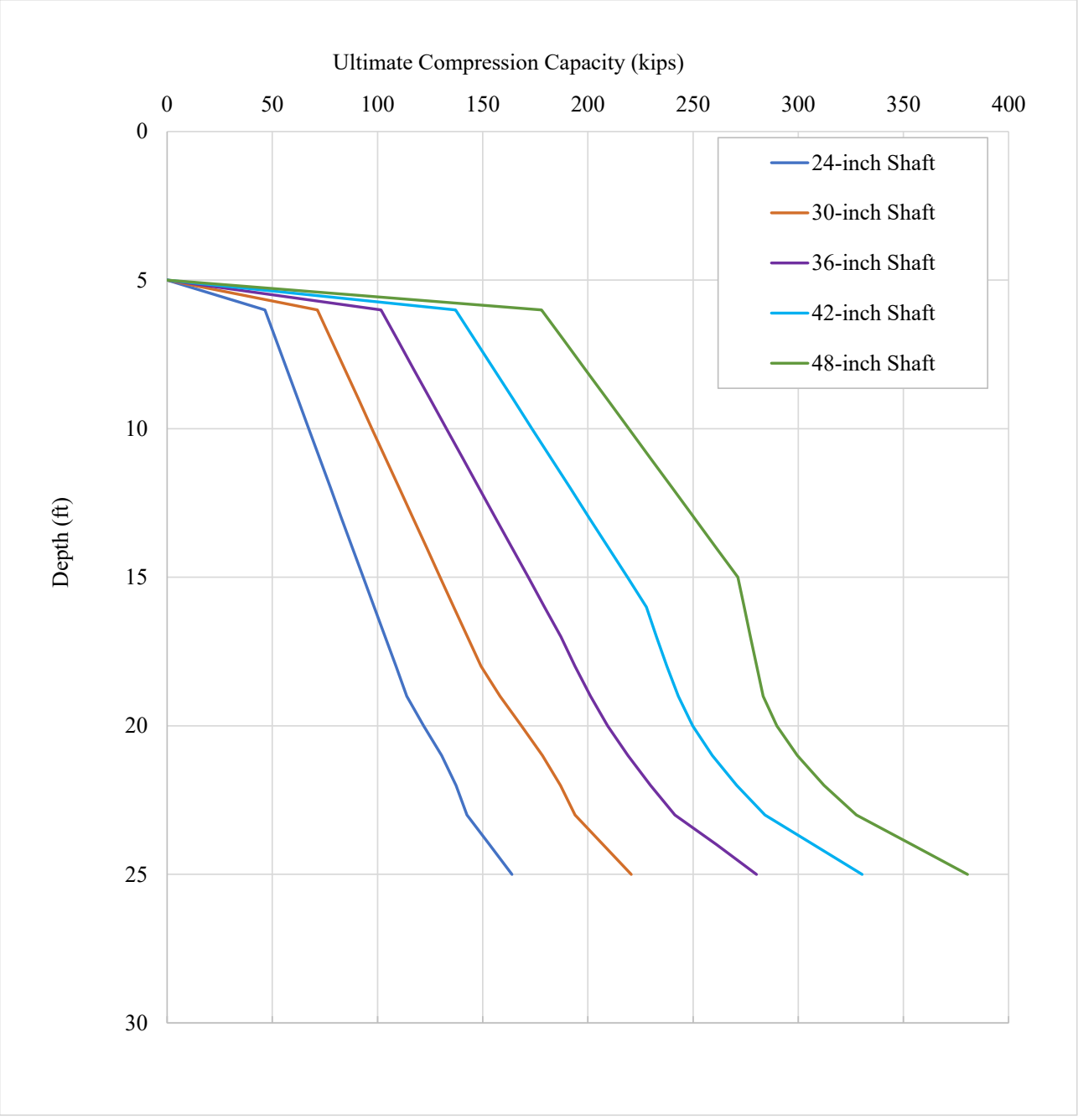


NOTE: BORING ELEVATIONS AND DISTANCE BETWEEEN BORINGS ARE APPROXIMATE VALUES OBTAINED FROM GOOGLE EARTH.

APPENDIX E

DRILLED SHAFT CAPACITY CURVES

STRAIGHT SIDED DRILLED SHAFT (1-STORY ATHLETIC FIELD HOUSE BUILDING)
ULTIMATE AXIAL CAPACITY IN COMPRESSION



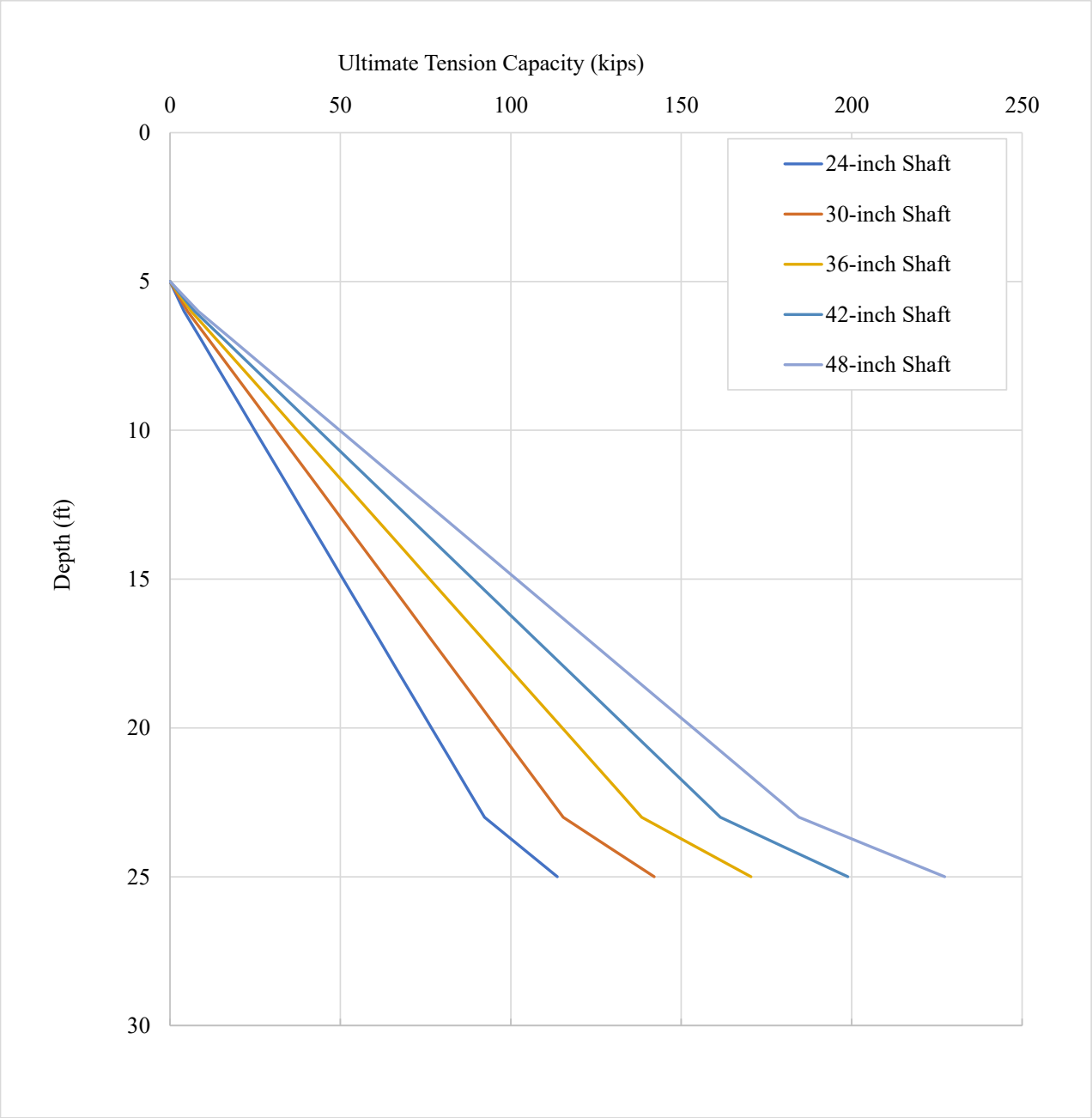
Note: 1. A Factor of Safety of 2.0 is recommended to arrive at allowable loads.
2. Pile capacity is based on existing subsurface condition.

HTS PROJECT NO. 24-S-300
PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
NEW CANEY INDEPENDENT SCHOOL DISTRICT
21650 TX-494 LOOP
NEW CANEY, TEXAS

HTS CONSULTANTS

PLATE E-1

STRAIGHT SIDED DRILLED SHAFT (1-STORY ATHLETIC FIELD HOUSE BUILDING)
ULTIMATE AXIAL CAPACITY IN TENSION



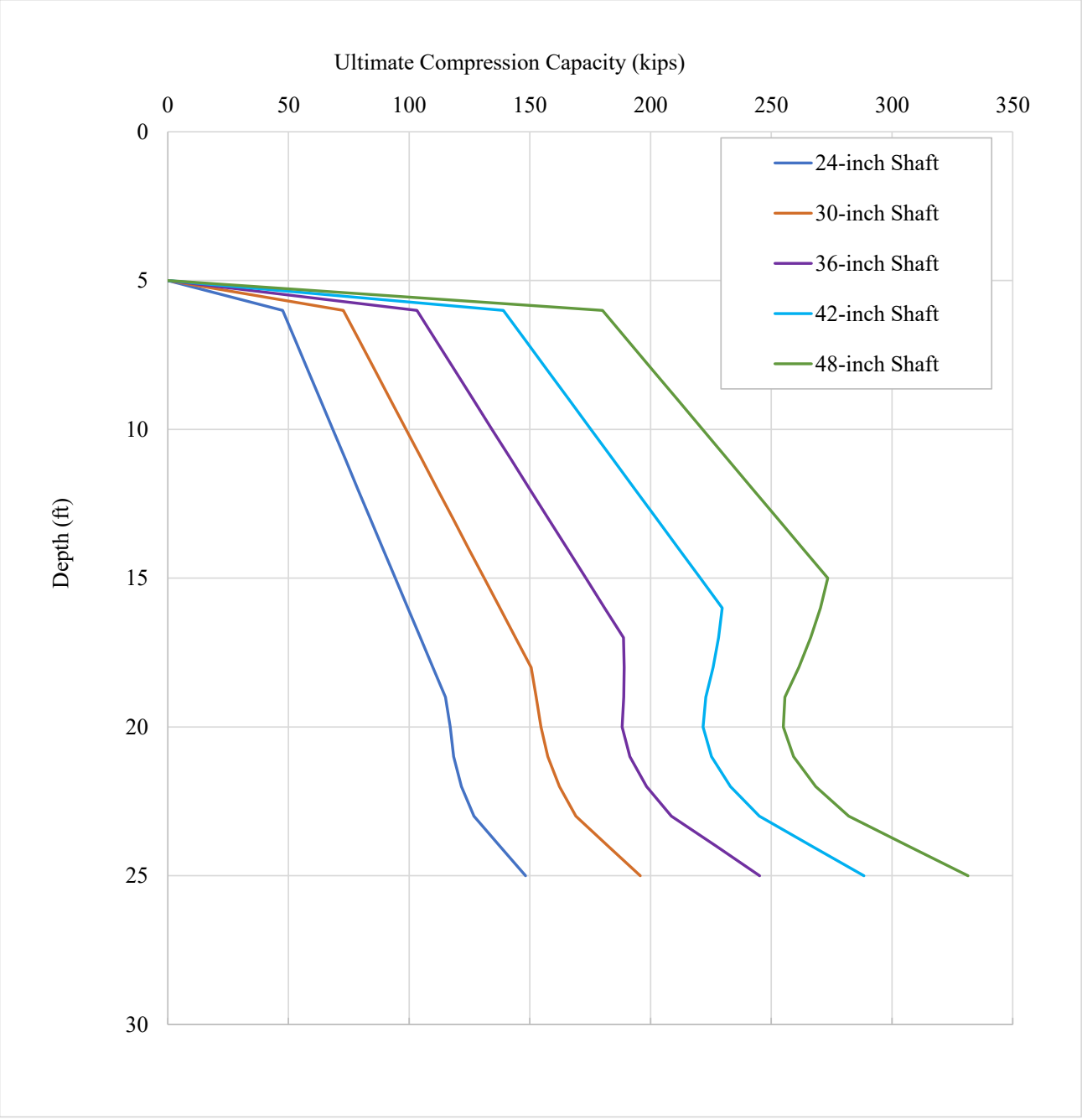
Note: 1. A Factor of Safety of 3.0 is recommended to arrive at allowable loads.
2. Adequate reinforcement should be provided for tension load.
3. Pile capacity is based on existing subsurface condition.

HTS PROJECT NO. 24-S-300
PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
NEW CANEY INDEPENDENT SCHOOL DISTRICT
21650 TX-494 LOOP
NEW CANEY, TEXAS

HTS CONSULTANTS

PLATE E-2

STRAIGHT SIDED DRILLED SHAFT (2-STORY PRESS BOX AND BLEACHERS)
ULTIMATE AXIAL CAPACITY IN COMPRESSION



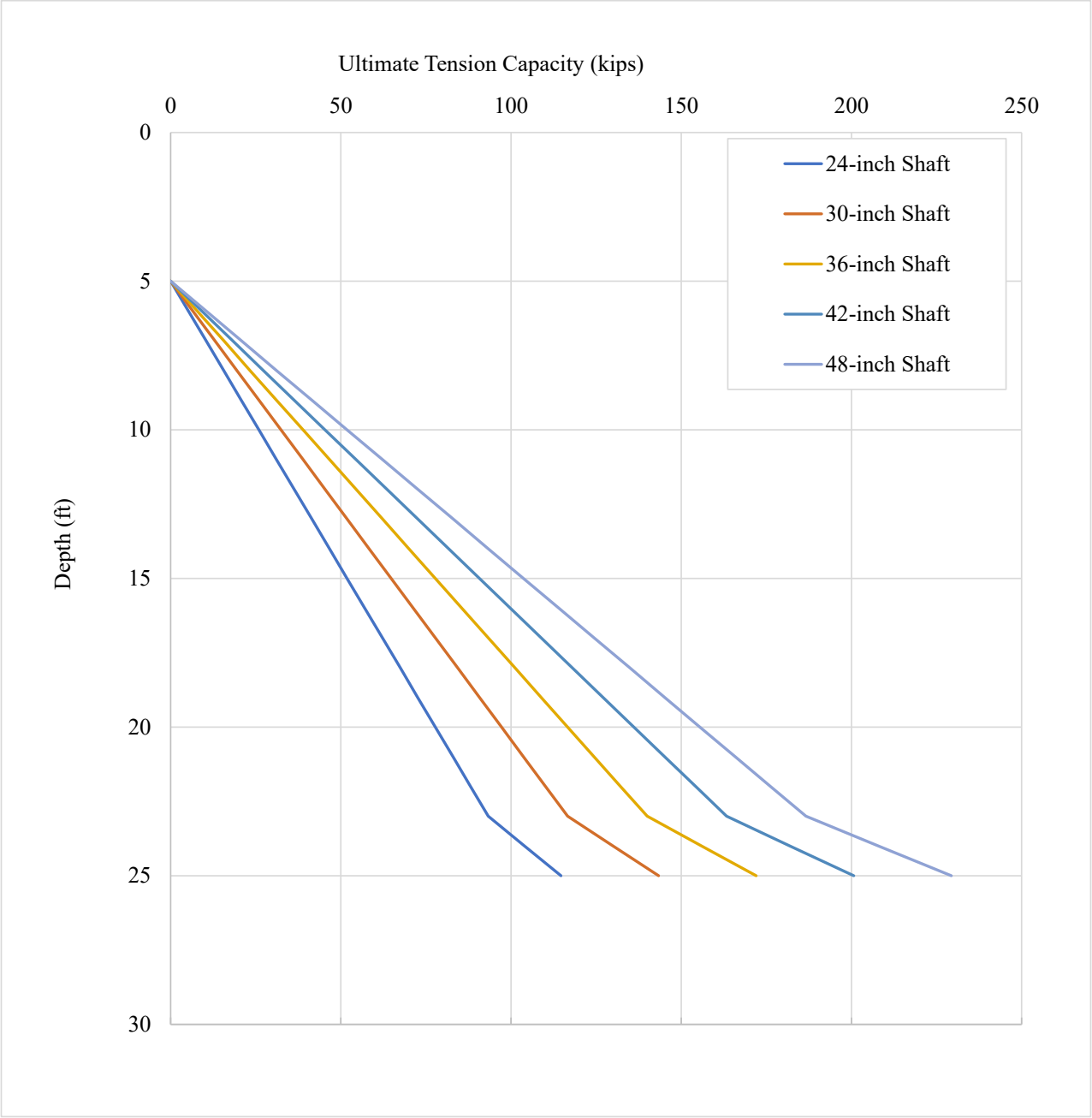
Note: 1. A Factor of Safety of 2.0 is recommended to arrive at allowable loads.
2. Pile capacity is based on existing subsurface condition.

HTS PROJECT NO. 24-S-300
PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
NEW CANEY INDEPENDENT SCHOOL DISTRICT
21650 TX-494 LOOP
NEW CANEY, TEXAS

HTS CONSULTANTS

PLATE E-3

STRAIGHT SIDED DRILLED SHAFT (2-STORY PRESS BOX AND BLEACHERS)
ULTIMATE AXIAL CAPACITY IN TENSION



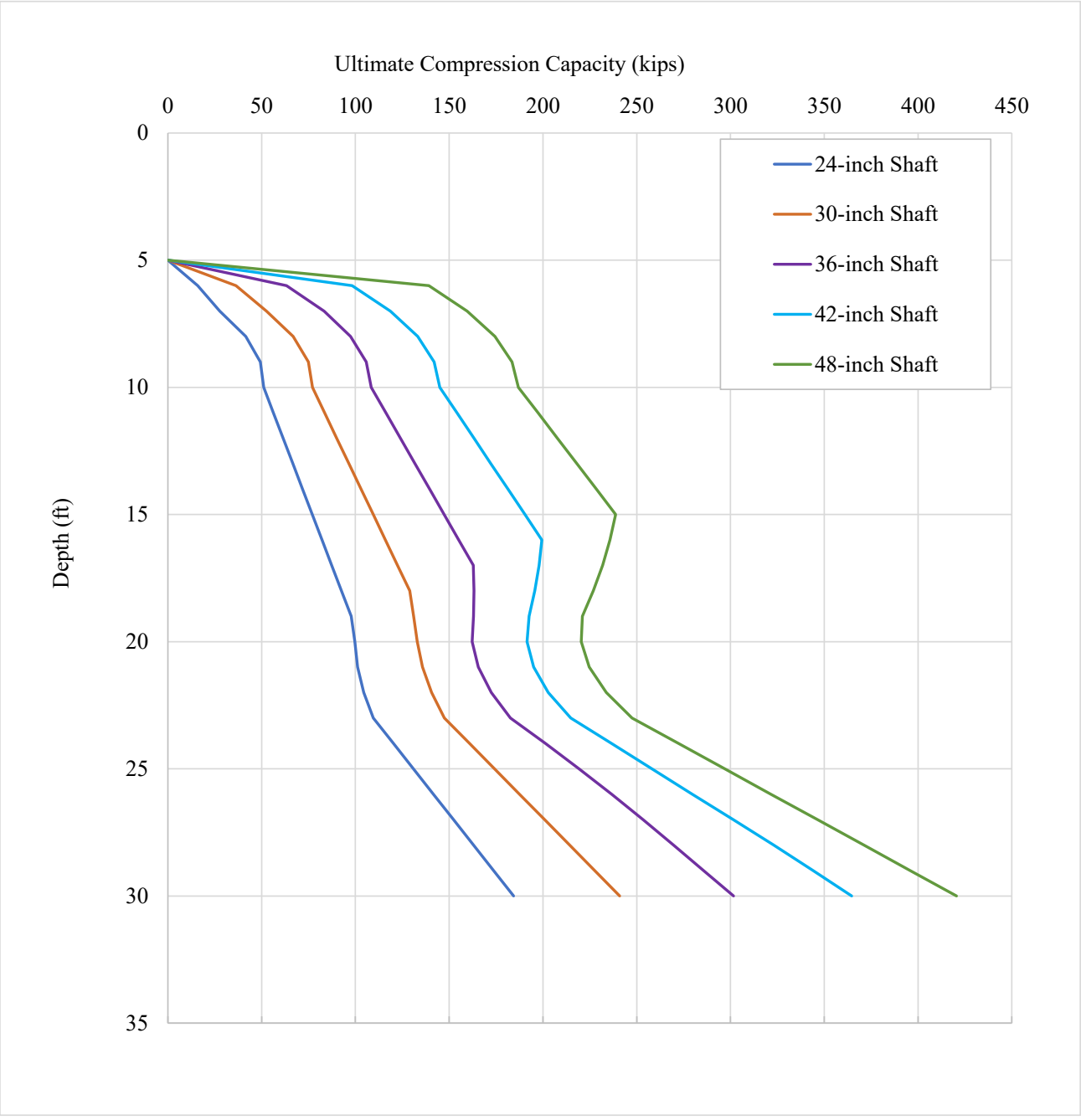
Note: 1. A Factor of Safety of 3.0 is recommended to arrive at allowable loads.
2. Adequate reinforcement should be provided for tension load.
3. Pile capacity is based on existing subsurface condition.

HTS PROJECT NO. 24-S-300
PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
NEW CANEY INDEPENDENT SCHOOL DISTRICT
21650 TX-494 LOOP
NEW CANEY, TEXAS

HTS CONSULTANTS

PLATE E-4

STRAIGHT SIDED DRILLED SHAFT (PRE-ENGINEERED METAL BUILDING)
ULTIMATE AXIAL CAPACITY IN COMPRESSION



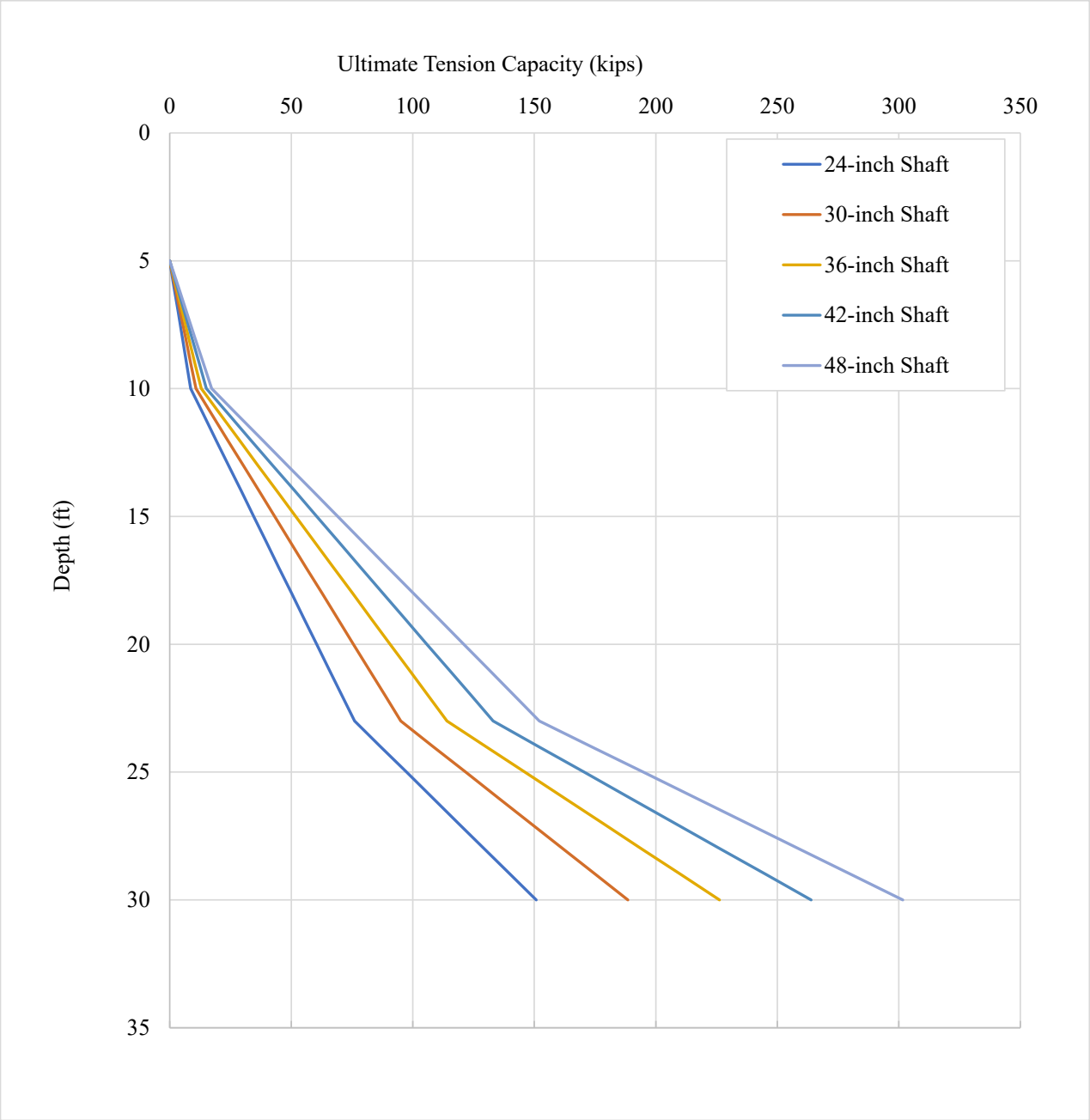
Note: 1. A Factor of Safety of 2.0 is recommended to arrive at allowable loads.
2. Pile capacity is based on existing subsurface condition.

HTS PROJECT NO. 24-S-300
PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
NEW CANEY INDEPENDENT SCHOOL DISTRICT
21650 TX-494 LOOP
NEW CANEY, TEXAS

HTS CONSULTANTS

PLATE E-5

STRAIGHT SIDED DRILLED SHAFT (PRE-ENGINEERED METAL BUILDING)
ULTIMATE AXIAL CAPACITY IN TENSION



Note: 1. A Factor of Safety of 3.0 is recommended to arrive at allowable loads.
2. Adequate reinforcement should be provided for tension load.
3. Pile capacity is based on existing subsurface condition.

HTS PROJECT NO. 24-S-300
PROPOSED NEW CANEY HIGH SCHOOL PHASE 3
NEW CANEY INDEPENDENT SCHOOL DISTRICT
21650 TX-494 LOOP
NEW CANEY, TEXAS

HTS CONSULTANTS

PLATE E-6

DOCUMENT 00 61 13.13

PERFORMANCE BOND FORM **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 this _____ day of _____, _____.

NEW CANEY HIGH SCHOOL EXTRACURRICULAR IMPROVEMENTS - PHASE III
NEW CANEY ISD
NEW CANEY, TEXAS

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 _____, _____.

_____ (Seal)
Principal

_____
Surety Address By: _____

_____ (Seal)
Surety

_____
Surety Telephone Number

By: _____
Attorney-in-Fact

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DOCUMENT 00 61 13.16

PAYMENT BOND FORM **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,
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 this _____ day of _____, _____.

NEW CANEY HIGH SCHOOL EXTRACURRICULAR IMPROVEMENTS - PHASE III
NEW CANEY ISD
NEW CANEY, TEXAS

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 pay all claimants supplying labor and material to him or a Subcontractor in the prosecution of the work provided for in said contract, 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 to all such claimants 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 _____, _____.

Witness: _____ (Seal)
Principal

_____ By: _____

Witness: _____ (Seal)
Surety

_____ By: _____
Attorney-in-Fact

_____

_____ _____
Surety Address Surety Telephone Number

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DOCUMENT 00 65 00

RELEASE OF LIEN DOCUMENTS

APPENDIX INDEX:

[Note: the attached forms are duplicated *verbatim* (without editing) from HB 1456.]

FORM 1: CONDITIONAL WAIVER FOR PROGRESS PAYMENTS

* * * * * * *

CONDITIONAL WAIVER AND RELEASE ON PROGRESS 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 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)

_____(Title)

FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS

* * * * * * *

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

Project:

Job No.:

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)

_____(Title)

FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENT

* * * * * * *

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)

_____(Title)

FORM 4: UNCONDITIONAL WAIVER FOR FINAL PAYMENT

* * * * * * *

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 up to the date of this waiver and release.

Date: _____

_____(Company name)

By _____(Signature)

_____(Title)

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SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Related Requirements:
   1. Document 00 21 16 - Instructions to Proposers.
   2. Section 01 32 16 - Construction Progress Schedules: Format of work schedule.
   3. Section 01 45 23 - Testing and Inspection Services.
   4. Section 01 50 00 - Temporary Facilities and Controls.

1.2 DESCRIPTION

A. The work comprises the construction of New Caney High School Extracurricular Improvements - Phase III for New Caney Independent School District, New Caney, Texas, as shown on the drawings and described in the specifications. The work will be done under one lump sum contract.

B. Indication on the drawings or mention in the specifications of articles, materials, operations or methods requires that the Contractor provide each item indicated or mentioned of the quality or subject to the qualifications noted, and perform according to the conditions stated each operation described and provide therefor all necessary labor, equipment, services and incidentals.
   1. Subcontractors are responsible for examining the architectural drawings for structural, mechanical, electrical, and plumbing items. Items shown on these drawings shall be furnished by the appropriate subcontractor.

1.3 CONDITIONS OF THE CONTRACT

A. The General Conditions **(**Modified**)** bound herewith as preceding portions of these specifications, form a part thereof and shall govern the work under each section.

1.4 EXISTING SITE CONDITIONS

A. Visit and examine the site. Upon award of the Contract, the Contractor shall accept the condition of the site before beginning the work required.

1.5 SPECIAL REQUIREMENTS

A. Execute Certificate of Substantial Completion for each designated portion of work prior to Owner occupancy. Following execution of a Substantial Completion Certificate for a designated portion of the work, the Contractor shall permit:
   1. Access for Owner personnel.

   Despite partial Owner occupancy, the Contractor shall remain responsible for portions of the work which have not attained Substantial Completion and for which a Substantial Completion Certificate, which shall designate the date on which the Owner shall become responsible for utilities, maintenance, security, damage to the work and insurance, has not been executed.

1.6 SEQUENCE OF CONSTRUCTION

A. Work shall commence as follows:
   1. Upon formal “Notice-to-Proceed” from the Owner, commence with the procurement of materials and equipment for the Project.
   2. Commence with the demolition of the existing buildings except for the existing Athletic Fieldhouse Building, and construction of the Project except for the Athletic Pre-engineered Building – June 16, 2025.
   3. Commence with the demolition of the existing Athletic Fieldhouse Building and construction of the Athletic Pre-engineered Building – December 1, 2025.

B. Work shall be substantially complete as follows:

1. The entire Project except for the Athletic Pre-engineered Building – June 29, 2026.
2. The Athletic Pre-engineered Building – August 3, 2026

C. The Contractor agrees that, from the compensation otherwise to be paid, the Owner may retain the sum of $1,000.00 for each calendar day after the Date of Substantial Completion that the work remains incomplete. This sum is agreed upon as the proper measure of Liquidated Damages which the Owner will sustain per diem by the failure of the Contractor to complete the work at the time stipulated in the Contract. This sum is not to be construed in any sense a penalty.

D. The successful Contractor may propose alternatives to this sequence of construction that would accelerate the work, provided there is no increase in the contract amount or extension of the contract time, or, in the Owner's judgment, any activity that would disrupt, impede, or prohibit normal school operations. Proposals shall be submitted in writing and are subject to the approval of the Owner and Architect.

1.7 CONTRACTOR USE OF PREMISES

A. Limit use of premises for work, for storage and for access, to allow for Owner occupancy.

B. Coordinate use of premises under direction of Owner.

C. Assume full responsibility for protection and safekeeping of products under this contract.

D. Obtain and pay for use of additional storage or work areas needed when required for operations under this Contract.

E. There shall be no fires on the site or in the building. There shall be no dumping on Owner's property.

F. Worker Identity Badging Requirements: If required by the Owner; provide construction personnel (including subcontractors and suppliers regularly visiting the project site) with identification badges, with photograph. Identification badges shall be worn visibly by construction personnel on the construction site or on Owner’s property. IF REQUIRED; NO EMPLOYEE WILL BE PERMITTED ON SITE WITHOUT THIS BADGE DISPLAYED ON THE EMPLOYEE. Contractor must assure that the Crisis Management contact information is provided on the reverse side of each worker’s badge. Temporary or visitor badges will be provided for persons who are identified as having an infrequent or temporary legitimate business need for access to the site.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed on the project site during normal business working hours of 6:00 a.m. to sundown, Monday through Friday or City ordinance whichever is more restrictive.
   1. Weekend Hours: Comply with City ordinance restrictions for weekend work. No work shall be performed on Sundays, unless specifically allowed by City and Owner.
   2. Early Morning Hours: Comply with City noise ordinances for restriction of early-morning concrete pours and other noisy construction activities. Owner’s testing laboratory personnel will be available only during on-site work hours listed above.

1.9 OWNER-FURNISHED PRODUCTS

A. Contractor Responsibilities
   1. Protect products from damage.
   2. Repair or replace items damaged by Contractor.
   3. Make all necessary electrical service connections to Owner supplied Sports Lighting.

B. Schedule of Owner-furnished items and Contractor installed items
   1. Paper Towel Dispensers.
   2. Soap Dispensers.
   3. Toilet Tissue Dispensers.

C. Schedule of Owner-furnished items and Owner installed items
   1. Sport Lights and concrete foundations.
   2. Aluminum Bleachers at Competition Baseball & Softball Fields. The concrete pier foundations shall be constructed by the Contractor.

1.10 COORDINATION

A. Drawing details and other sections of these specifications covering work connected with or relating to that specified under a specific heading shall be examined for conditions which may affect that part of the work. Failure to do so will not relieve those furnishing materials and/or labor under a specification heading from supplying materials or performing work reasonably necessary to properly coordinate their work with that of other trades.

1.11 LAYING OUT WORK, MEASUREMENTS

A. Employ a competent engineer or surveyor to establish and maintain lines and levels. Establish and maintain at least two elevation bench marks remote from each other and located outside the building area. Set alignment and location stakes.

B. Verify measurements at the site. No extra compensation will be allowed for differences between actual dimensions and dimensions indicated on the drawings. Figured dimensions and measurements taken at the site shall take precedence over scaled dimensions.

1.12 PIPING

A. Should active piping or conduit be encountered below grade and be found at variance with the known conditions indicated by the drawings and specifications, said piping and/or conduit shall be relocated as required by the Architect, and the contract sum shall be fairly adjusted on the basis of the cost of labor and materials. The Contractor shall provide temporary support of active piping and conduit encountered in the excavations until permanently supported or removed. The Contractor shall cut off and cap or plug abandoned lines. Conform to the applicable requirements of the locality or governing agency.

1.13 DISCREPANCIES

A. In case of discrepancies within the drawings, within the specifications, or between the drawings and specifications, the better quality and greater quantity, in the opinion of the Architect, shall be furnished and installed.

1.14 PROTECTION

A. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy in adjacent spaces and around the site.
   1. Confine operations to areas within Contract limits indicated. Portions of the site which are outside the area of construction operations are not to be disturbed.
   2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees. Do not use these areas for parking or storage of materials without prior approval.
      Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
   3. Do not dispose of organic and hazardous material on site, either by burial or by burning. Disposable material and trash must be removed properly.

B. Assume responsibility for the premises and provide and maintain protections required by the governing laws, regulations and ordinances. The Contractor shall be responsible for loss or damage caused by him or his workmen to the property of the Owner or to the work or materials installed, and shall make good loss, damage or injury without cost to the Owner.

C. The protection of adjacent property shall include but will not necessarily be limited to the erection and maintenance of shoring, underpinning and fences as necessary to protect and support existing work to be left in place.

D. Trees and shrubs on the site which do not have to be removed for the new work shall be protected against damage. No Contractor shall remove or trim trees and shrubs in the area without the express approval of the Architect.

1.15 CUTTING AND PATCHING

A. Cutting and chasing of existing construction for relocation of mechanical and electrical work and for installation of pipes and ducts will be done by the trades concerned. Patching and finishing shall be done by the Contractor. This work shall be done with proper tools and by careful workmen of the particular trade to which such work belongs and shall be done without extra cost to the Owner.

1.16 RECORD DRAWINGS

A. Maintain a complete clean set of drawings and Project Manual in the project field office for the sole purpose of recording "installed" conditions. Installed conditions shall include addendum items, change orders, or other items which come up during the construction phase which deviate from the Construction Documents. Changes made in these drawings and Project manual in connection with the final construction and installation shall be neatly made in red ink. Upon completion of the project, the marked set of drawings and Project Manual shall be delivered to the Architect for subsequent transmittal to the Owner. These drawings shall be maintained to reflect the current conditions of the work and changes shall be reviewed on a monthly basis with the Architect’s representative. The Contractor's updating of the "installed" condition drawings and Project Manual shall be a prerequisite to the monthly review of the Contractor's payment request by the Architect's representative.

PART 2 - PRODUCTS

Not used

PART 3 - EXECUTION

Not used

END OF SECTION

SECTION 01 22 00

UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for unit prices.

B. Related Requirements:
1. Section 01 29 00 - Payment Procedures: Procedures for submitting and handling Change Orders.

1.2 DEFINITIONS

A. Unit price is an amount proposed by bidders as a price per unit of measurement for materials or services added to or deducted from the contract sum by appropriate modification, if the estimated quantities of work required by the contract documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, profit and applicable taxes.

B. Measurement and Payment: Refer to individual specification sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those sections.

C. The Owner reserves the right to reject the Contractor's measurement of work-in-place that involves use of established unit prices, and to have this work measured, at the Owner's expense, by an independent surveyor acceptable to the Contractor.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE

A. General: Each unit price for CREDIT shall be at least 66% of the corresponding unit price for EXTRA.

B. Unit Price No. 1

	SIZE	EXTRA	CREDIT
120V duplex receptacle on nearest capable circuit.	each	$_____	$_____

C. Unit Price No. 2

	SIZE	EXTRA	CREDIT
120V duplex receptacle on dedicated circuit, including 20-amp circuit breaker and 200 feet of pathway to Panelboard.	each	$_____	$_____

D. Unit Price No. 3

	SIZE	EXTRA	CREDIT
Single data drop, flush mounted in wall j-box with 1-1/4”, terminated at wall and patch panel, labeled, tested, conduit stubbed up wall to above ceiling and 200 feet of cabling.	each	$_____	$_____

E. Unit Price No. 4

	SIZE	EXTRA	CREDIT
1,000 square yards of bermudagrass sod on prepared soil, with maintenance, including watering, for three months past substantial completion.	each	$_____	$_____

F. Unit Price No. 5

	SIZE	EXTRA	CREDIT
1,000 square yards of bermudagrass hydromulch on prepared soil, with maintenance, including watering, for three months past substantial completion.	each	$_____	$_____

G. Unit Price No. 6

	SIZE	EXTRA	CREDIT
Cubic yard of excavation of dirt or caliche, including trucking off site.	each	$_____	$_____

H. Unit Price No. 7

	SIZE	EXTRA	CREDIT
Cubic yard of backfilling, meeting fill requirements of construction documents, from off-site sources, compacted in lifts as required by construction documents.	each	$_____	$_____

I. Unit Price No. 8

	SIZE	EXTRA	CREDIT
Cubic yard of concrete, including pumping, placement, and finishing.	each	$_____	$_____

J. Unit Price No. 9

	SIZE	EXTRA	CREDIT
Additional Lime-Flyash treated subgrade. Square yard compacted in lifts as required by construction documents.	each	$_____	$_____

K. Unit Price No. 10

	SIZE	EXTRA	CREDIT
Casings for drilled piers, per linear foot.	_____ dia.	$_____	$_____
	_____ dia.	$_____	$_____
	_____ dia.	$_____	$_____

END OF SECTION

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included:
1. Identification and description of alternate work.
2. The amount shown in the proposal form for each alternate shall include all overhead, profit, insurance and other costs incidental to the performance under the alternate.

B. Related Requirements:
1. Proposal Form: Quotation of cost of each alternate.
2. Contract Form: Alternates accepted by Owner for incorporation into the work.
3. Section of specifications identified in each alternate.

1.2 PROCEDURES

A. Proposers are required to submit alternate amounts to add work or to deduct work from the base proposal as described below. Failure to submit alternate amounts in spaces provided on proposal form shall be basis for disqualification of proposal.

B. The successful proposer shall not modify, withdraw or cancel any of the alternate proposals or any part thereof for 30 days after date of receipt of proposals, unless specifically noted otherwise.

C. Contractor shall be responsible for any changes in the Work affected by acceptance of alternates. Claims for additional costs or time extensions resulting from changes to the Work as a result of the Owner's election of any or all alternates will not be allowed.

D. Refer to drawings and technical specifications sections for items of work affected by alternates.

E. Election of alternates will be exercised at the option of Owner.

F. Coordinate related work and modify or adjust surrounding work as required to complete the Work, including changes under each alternate.
1. Include as part of each alternate, miscellaneous devices, accessory objects and similar items incidental to, or required for, a complete installation whether or not indicated as part of alternate.
2. Cost listed for each alternate include cost of related coordination, modification, or adjustment.

G. Notification: Immediately following the award of contract, Contractor shall prepare and distribute to each entity or person to be involved in the performance of the Work, a notification of the status of each alternate scheduled herein. Indicate which alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates, if any.

1.3 SELECTION AND AWARD OF ALTERNATES

A. Indicate variation in base proposal amount as a result of the prices for the alternates described below and listed on the proposal form document or any supplement to it, by adding to, or deducting from, the base proposal amount or by indicating " No Change.

B. Indicating "No Proposal" as an alternate is unacceptable and is reason for rejection of proposal.

1.4 SCHEDULE OF ALTERNATES

A. Alternate No. 1A: Air Cooled Chillers by Carrier.
Base Proposal: No Air Cooled Chillers.

B. Alternate No. 1B: Air Cooled Chillers by Trane.
Base Proposal: No Air Cooled Chillers.

C. Alternate No. 1C: Air Cooled Chillers by York/JCI.
Base Proposal: No Air Cooled Chillers.

D. Alternate No. 1D: Air Cooled Chillers by Daikin.
Base Proposal: No Air Cooled Chillers.

E. Alternate No. 2A: Infilled Synthetic Turf System by Field Turf.
Base Proposal: No Infilled Synthetic Turf System.

F. Alternate No. 2B: Infilled Synthetic Turf System by Hellas.
Base Proposal: No Infilled Synthetic Turf System.

G. Alternate No. 2C: Infilled Synthetic Turf System by Paragon.
Base Proposal: No Infilled Synthetic Turf System.

H. Alternate No. 2D: Infilled Synthetic Turf System with Full Fill Cooling System by Field Turf.
Base Proposal: No Infilled Synthetic Turf System.

I. Alternate No. 2E: Infilled Synthetic Turf System with Full Fill Cooling System by Hellas.
Base Proposal: No Infilled Synthetic Turf System.

J. Alternate No. 2F: Infilled Synthetic Turf System with Full Fill Cooling System by Paragon.
Base Proposal: No Infilled Synthetic Turf System.

K. Alternate No. 3A: Track System by Beynon.
Base Proposal: No Track System.

L. Alternate No. 3B: Track System by Hellas.
Base Proposal: No Track System.

M. Alternate No. 3C: Track by Paragon.
Base Proposal: No Track System.

N. Alternate No. 4: Lighting Controls.
Base Proposal: No Lighting Controls.

O. Alternate No. 5: Adjustment to Base Proposal.
Base Proposal: No Adjustment to Base Proposal.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Applications and Certificates for Payment.
   2. Change Order Procedures.
   3. Schedule of Values: Submit to the Architect and the Program Manager the Schedule of Values allocated to various portions of the work within five days after "Notice-to-Proceed". Upon request of Architect, support values with data which will substantiate their correctness.

B. Related Requirements:
   1. Conditions of the Contract for Construction.
   2. Section 01 32 16 - Construction Progress Schedules.
   3. Section 01 77 00 - Closeout Procedures.
   4. Section 01 78 39 - Project Record Documents.

1.2 APPLICATIONS AND CERTIFICATES FOR PAYMENT

A. Progress payments shall be made as the work proceeds at intervals stated in the Contract.

B. Work covered by progress payments shall, at the time of payment, become the property of the Owner.

C. Form of Application and Certificate for Payment shall be notarized AIA Document G702 - Application and Certification for Payment, supported by AIA document G703 - Continuation Sheet. Submit two hard copies. Architect will retain a digital copy and return signed hard copies to the Owner and Contractor.

D. Conditions governing regular schedule for applications, payment and retainage are as stated in the Contract.

E. With each Application for Payment, Contractor shall certify that such Application for Payment represents a just estimate of cost reimbursable to Contractor under terms of Contract.

1.3 CONSTRUCTION CHANGE ORDER PROCEDURES

A. Contractor to submit to Architect within five days of execution of Owner/Contractor Agreement name of individual authorized to accept changes on behalf of Contractor, and to be responsible for informing others in Contractor's employ of changes in the work.

B. Change Order forms will be furnished and issued by Architect.

C. Contractor Documentation of Changes:
   1. Maintain detailed records of work done on an accounting basis acceptable to Architect and Owner. Provide full information required for evaluation of proposed changes.
   2. Document each quotation for a change in cost or time with sufficient data to allow evaluation of quotation.
   3. On request, provide additional data to support computations:
      a. Quantities of products, labor and equipment.
      b. Insurance and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   4. Support each request for additional costs, and for work proposed on a time and material basis, with description of products, equipment, cost of labor and subcontracts, completely documented.
   5. Computation for changes in work will be computed in one of the manners described in the Conditions of the Contract.

D. Initiation of Changes:
   1. Architect may submit Proposal Request which includes detailed description of change with supplementary or revised drawings and specifications.

2. Contractor may initiate a proposed change by submittal of a request to Architect describing proposed change with statement of reason for change, and proposed effect on Contract Sum and Contract Time with full documentation and a statement of the effect on work of separate contractors. Document any requested substitutions in accordance with SECTION 01 62 00 - PRODUCT OPTIONS. Submission of such requests and receipt of same by Architect does not mean acceptance, or approval of proposed change.

E. Authorization:
1. The Owner may request, through the Architect, a Construction Change Directive, in writing, instructing Contractor to proceed with changes of all or in part of work, for subsequent inclusion in a Change Order that is pending. Directive will propose basis for necessary adjustments, if any, to Contract Sum or Time.
2. Changes that affect Contract Sum and/or Contract Time will require a Change Order signed by the Owner and the Architect. Contractor's signature indicates agreement. Other orders, written or oral, by the Owner through the Architect or by the Architect shall be treated as a Change Order only if Contractor gives Owner proper written notice as described in Conditions of Contract.
3. Promptly execute the change in work only upon receipt of approved Change Order or Owner's written Construction Change Directive.

F. Execution:
1. Architect will issue Change Orders for signatures of parties as provided in Conditions of Contract.
2. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust Contract Sum as shown on Change Order.
3. Promptly revise Progress Schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by Change, and resubmit Schedule.
4. Promptly enter Changes in Project Record Documents.

1.4 SCHEDULE OF VALUES FORM AND CONTENT

A. Type schedule on 8-1/2" x 11" white paper; Contractor's standard forms and automated printout will be considered for approval by Architect upon Contractor's request. Identify schedule with:
1. Title of project and location.
2. Architect and Architect's project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Follow the table of contents of this project manual as the format for listing component items.
1. Identify each line item with the number and title of the respective major section of the specifications.

C. For each major line item list sub-values of major products or operations under the item.

D. For the various portions of the work:
1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
2. For items on which progress payments will be requested for stored materials, break down the value into:
a. Cost of the materials, delivered and unloaded, with taxes paid.
b. Total installed value.

E. The sum of values listed in the schedule shall equal the total contract sum.

F. Indicate separate value associated with materials and labor.

G. Re-submittal: After review by Architect, revise and resubmit schedule as necessary.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Coordination of work of the contract.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Sequence of construction and Owner occupancy.
2. Section 01 31 19 - Project Meetings.
3. Section 01 62 00 - Product Options.
4. Section 01 73 29 - Cutting and Patching.
5. Section 01 77 00 - Closeout Procedures: Closeout submittals.

1.2 DESCRIPTION

A. Coordinate scheduling, submittals and work of the various sections of specifications to ensure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items to be installed later.

B. Coordinate sequence of work to accommodate Owner occupancy as specified in SECTION 01 11 00 - SUMMARY OF WORK.

1.3 MEETINGS

A. In addition to progress meetings specified in SECTION 01 31 19 - PROJECT MEETINGS, hold coordination meetings and pre-installation conferences with personnel and subcontractors to ensure coordination of work.

1.4 COORDINATION OF SUBMITTALS

A. Schedule and coordinate submittals specified in SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Coordinate work of various sections having interdependent responsibilities for equipment, such as installing, connecting to and placing in service.

C. Coordinate requests for substitutions to ensure compatibility of space, of operating elements and effect on work of other sections.

1.5 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's work or work of subcontractors.
3. Contractor shall always include a proposed solution along with the RFI.
4. RFI’s submitted to the Contractor by subcontractors, vendors, suppliers, or other parties to the Work shall be reviewed by the Contractor prior to submission to the Architect. If the Architect deems that such RFI requests have not been adequately reviewed by the Contractor, such requests will be returned to the Contractor for further action.
5. RFI requests are limited to a request for interpretation or clarification of the requirements of the Contract Documents. Interpretations provided by the Architect shall not change the requirements of the Contract or the Contract Documents. If the Contractor determines that the Architect’s response to an RFI gives cause for a change in the Contract or the Contract Documents, the Contractor shall promptly, within 5 working days, give written notice to the Architect of request for adjustments. Requests for adjustments to the Contract shall be submitted in a manner consistent with the terms and conditions of the Contract Documents.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Owner name.
   3. Owner's Project number.
   4. Name of Architect.
   5. Architect's Project number.
   6. Date.
   7. Name of Contractor.
   8. RFI number, numbered sequentially.
   9. RFI subject.
   10. Specification Section number and title and related paragraphs, as appropriate.
   11. Drawing number and detail references, as appropriate.
   12. Field dimensions and conditions, as appropriate.
   13. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   14. Contractor's signature.
   15. 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. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow five 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 Contractor-generated RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for approval of Contractor's means and methods.
      d. Requests for coordination information already indicated in the Contract Documents.
      e. Requests for adjustments in the Contract Time or the Contract Sum.
      f. Requests for interpretation of Architect's actions on submittals.
      g. 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 by Architect of additional information.

1.6 COORDINATION OF SPACE

A. Coordinate use of project space and sequence of installation of mechanical and electrical work which is indicated diagrammatically on drawings. Follow routings shown for pipes, ducts and conduits as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance and for repairs.

B. In finished areas, except as otherwise shown, conceal pipes, ducts and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

1.7 COORDINATION OF CONTRACT CLOSEOUT

A. Coordinate completion and cleanup of work of separate sections in preparation for substantial completion of portions of work designated for Owner partial occupancy.

B. After Owner occupancy of premises, coordinate access to site by various sections for correction of defective work and work not in accordance with contract documents, to minimize disruption of Owner's activities.

C. Assemble and coordinate closeout submittals specified in SECTION 01 77 00 - CLOSEOUT PROCEDURES.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 31 19

PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Scheduling and administration of progress meetings.
2. Pre-installation conferences.

B. Related Requirements:
1. Section 01 31 00 - Project Management and Coordination.
2. Section 01 31 19.13 - Preconstruction Meetings: Owner's preconstruction conference and pre-mobilization conference.
3. Section 01 32 16 - Construction Progress Schedules.
4. Section 01 33 23 - Shop Drawings, Product Data and Samples.
5. Section 01 45 00 - Quality Control.
6. Section 01 78 23 - Operation and Maintenance Data.
7. Section 01 78 39 - Project Record Documents.

1.2 PROGRESS MEETINGS

A. The Contractor will schedule bi-weekly construction progress meetings, throughout progress of work. They will prepare agenda and distribute notice of each meeting to participants.

B. Contractor shall make physical arrangements.

C. Contractor will preside at meetings and issue meeting minutes.

D. Location of Meetings: Contractor's field office.

E. Attendance: Contractor, job superintendent, Architect and Owner. Professional consultants will attend as appropriate. Subcontractors and suppliers shall attend as Architect or Contractor sees necessary to agenda.

F. Anticipated Agenda:
1. Review of any outstanding old business from prior meeting minutes.
2. Review of Contractor's updated Construction Schedule, including minimum two-week look ahead schedule.
3. Review of work in-progress.
4. Field observations and decisions.
5. Status of correction of deficient items.
6. Review of outstanding RFI’s.
7. Identification of problems which impede planned progress.
8. Review of submittal schedule and status of submittals, including pending submittals and resubmittals.
9. Review of off-site fabrication and delivery schedules.
10. Corrective measures to regain projected schedules if project is behind schedule.
11. Review of quality and work standards.
12. Review of Proposal Request and Change Proposal Logs, including any known pending changes.
13. Effect of proposed changes on progress schedule and coordination.
14. Review of Contractor’s updates to Project Record Documents.
15. Review and signing of formal Application for Payment, as applicable.
16. For Construction Manager projects, discuss variances between actual and estimated GMP costs.
17. Other business relating to work.

1.3 PRE-INSTALLATION CONFERENCES

A. When required in individual specification section, convene a pre-installation conference at work site prior to commencing work of the section.

B. Require attendance of entities directly affecting, or affected by, work of the section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda, preside at conference, record minutes and distribute copies within two days after conference to participants, with two copies to Architect.

E. Review conditions of installation, preparation and installation procedures and coordination with related work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 31 19.13

PRECONSTRUCTION MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Contractor participation in preconstruction meetings.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Administrative provisions.
2. Section 01 31 00 - Project Management and Coordination.
3. Section 01 31 19 - Project Meetings.

1.2 PRECONSTRUCTION MEETING

A. Architect will schedule meeting within 5 days after notice of award.

B. Attendance: Owner, Architect, General Contractor and representatives of major subcontractors.

C. Agenda
1. Submittal of executed bonds and insurance certificates.
2. Execution of Owner-Contractor Agreement.
3. Distribution of Contract Documents.
4. Submittal of list of subcontractors, list of products, schedule of values and progress schedule.
5. Designation of responsible personnel.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal requests, change orders, allowances and Contract closeout procedures.
7. Scheduling.
8. Use of premises by Owner and Contractor.
9. Owner's requirements and occupancy.
10. Temporary facilities.
11. Survey and building layout.
12. Security and housekeeping procedures.
13. Procedures for testing.
14. Procedures for maintaining record documents.
15. Requirements for startup of equipment.
16. Accessibility Issues.
17. Inspection and acceptance of equipment put into service during construction period.
18. Notice to proceed.
19. Color samples.
20. Procedures for site meetings.
21. Site access and security.
22. Procedures and processing of TEA “Certification of Project Compliance” form.
23. Substantial and final project completion procedures.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 32 16

CONSTRUCTION PROGRESS SCHEDULES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedures for preparation and submittal of digital construction progress schedules and periodical updating.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Work sequence.
2. Section 01 29 00 - Payment Procedures: Schedule of Values.
3. Section 01 33 23 - Shop Drawings, Product Data and Samples.

1.2 SUBMITTALS

A. Within 21 days of the contract date, Contractor shall prepare and submit a digital Critical Path construction schedule for the work. After review, resubmit required revised data within 5 days.

B. Submit revised digital Critical Path Construction Schedule monthly with each Application for Payment.

C. Submit under transmittal letter specified in SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 WORK SCHEDULE FORMAT

A. The schedule shall not exceed time limits current under the Contract Documents and shall be subject to the approval of the Architect. The Contractor shall prosecute the work vigorously and make every effort to start and complete each phase of the work on or before the dates stated.

B. Should actual construction of project vary from the Critical Path schedule, Contractor shall take whatever actions are necessary to improve progress as quickly as possible in order to meet pre-determined milestones. Revise and re-submit schedule not less than every 30 calendar days. Presentation of the existing or updated Critical Path schedule, in three copies, along with the Certificate of Payment Request shall be a prerequisite to the monthly review of the payment request by the Architect's representative.

C. Sequence of Listings: The chronological order of the start of each item of work.

D. Scale and Spacing: To provide space for notations and revisions.

E. Sheet Size: Minimum 11" x 17".

1.4 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by major specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Provide sub-schedules for each stage of work identified in SECTION 01 11 00 - SUMMARY OF WORK.

E. Provide sub-schedules to define critical portions of entire schedule.

F. Show accumulated percentage of completion of each item, and total percentage of work completed, as of the first day of each month.

G. Provide separate schedule of submittal dates for shop drawings, product data and samples, including Owner furnished products and products specified under Allowances, and dates reviewed submittals will be required from Architect. Show decision dates for selection of finishes.

H. Show delivery dates for Owner furnished products and products specified under Allowances.

I. Coordinate content with SECTION 01 29 00 - PAYMENT PROCEDURES, Schedule of Values.

1.5 REVISIONS TO SCHEDULES

A. Indicate progress of each activity to date of submittal, and projected completion date of each activity.

B. Identify activities modified since previous submittal, major changes in scope and other identifiable changes.

C. Provide narrative report to define problem areas, anticipated delays and impact on Schedule. Report corrective action taken or proposed, and its effect.

1.6 DISTRIBUTION

A. Distribute copies of reviewed schedules to job site file, subcontractors, suppliers and other concerned entities.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 32 23

SURVEY AND LAYOUT DATA

PART 1 G E N E R A L

1.01 QUALITY CONTROL

A. Conform to State of Texas laws for surveys requiring licensed surveyors. Employ a surveyor acceptable to Owner's Representative if required by the Contract.

1.02 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit the name, address, and telephone number of Surveyor to Owner's Representative before starting survey work.

C. Submit documentation verifying accuracy of survey work on request.

D. Submit certificate signed by Surveyor, that elevations and locations of the Work are in conformance with the Contract.

1.03 PROJECT RECORD DOCUMENTS

A. Maintain a complete and accurate log of control and survey work as it progresses.

B. Prepare a certified survey setting forth dimensions, locations, angles, and elevations of construction and site work upon completion of foundation walls and major site improvements.

C. Submit record documents under provisions of Division 1.

1.04 EXAMINATION

A. Verify locations of survey control points prior to starting the Work.

B. Notify the Owner's Representative immediately if any discrepancies are discovered.

1.05 SURVEY REFERENCE POINTS

A. The Owner will establish survey control datum as indicated on Drawings. Inform Owner's Representative in advance of time additional horizontal and vertical control points will be established so verification deemed necessary by Owner's Representative may be done with minimum inconvenience to the Owner or Contractor.

B. Locate and protect survey control points prior to starting site work; preserve permanent reference points during construction.

C. Notify the Owner's Representative a minimum of 48 hours before relocation of reference points is needed due to changes in grades or other reasons.

D. Promptly report loss or destruction of reference points to Owner's Representative.

E. Reimburse the Owner for cost of reestablishment of permanent reference points disturbed by construction operations.

1.06 SURVEY REQUIREMENTS.

A. Utilize recognized engineering survey practices.

B. Establish a minimum of two permanent benchmarks on site, referenced to established control points. Record horizontal and vertical location data on Project record documents.

C. Establish elevations, lines and levels to provide quantities required for measurement and payment and for appropriate controls for the Work. Locate and lay out the following with appropriate instruments:

1. Site improvements including grading, fill and topsoil placement, utilities, and footings and slabs.
2. Grid or axis for structures.
3. Building foundation, column locations, and ground floor elevations.

D. Periodically verify layouts.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N – Not Used

END OF SECTION 01 32 23

SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Digital submission of shop drawings.

B. Related Requirements:
1. General Conditions of the Contract for Construction: Definitions and basic responsibilities of entities.
2. Section 01 31 00 - Project Management and Coordination: Coordination of submittals.
3. Section 01 32 16 - Construction Progress Schedules: Schedules for submittals.
4. Section 01 45 00 - Quality Control: Mockups and samples for testing.
5. Section 01 50 00 - Temporary Facilities and Controls: Project management software.
6. Section 01 62 00 - Product Options.
7. Section 01 78 23 - Operation and Maintenance Data.
8. Section 01 78 39 - Project Record Documents.

1.2 GENERAL

A. Refer to General Conditions, Paragraph 3.12 (Shop Drawings, Product Data and Samples).

B. Digital Submittals: Submit to the Architect and Program Manager, or applicable consultant, shop drawings, product data, and samples required by specification sections. Do not submit illegible fax copies nor carbon copies of shop drawings and product data.
1. Submit using the Owner's web-based project management program. Prepare submittals as .pdf files, with a single file for each submittal, and upload to the Owner's project management program. Enter required data in program to fully identify submittal in accordance with the required submittal numbering format.

C. Within 30 days of the contract date Contractor shall prepare and submit with the Schedule of Values a comprehensive schedule of shop drawings, product data and samples. This schedule shall include products which are proposed for substitution. Also include the estimated date of each submittal and anticipated date of submittal return. Allow the Architect reasonable time to review submittals.
1. The schedule shall be compiled and submitted using the "Submittal" feature in the Owner's project management program.

D. Prepare schedule on basis of each specification section.

E. For products specified under reference standards, include with listing of each product:
1. Name and address of manufacturer.
2. Trade name.
3. Model or catalog designation.
4. Manufacturer's data, including performance and test data, reference standards.

1.3 SHOP DRAWINGS

A. Prepared by a qualified detailer. Prepare project-specific information, drawn accurately to scale. Do not base shop drawings on reproductions of the contract documents or standard printed data. Include supplier's / detailer's / manufacturer's title block.

B. Identify details by reference to sheet and detail numbers shown on Contract Documents.

C. Present in a clear and thorough manner original drawings which illustrate the portion of the work showing fabrication, layout, setting, or erection details, prepared by a qualified detailer. Title each drawing with Project and Contract name and number; identify each element of drawings by reference to sheet number and detail, schedule, or room number of Contract Documents.

1.4 PRODUCT DATA

A. Manufacturer's standard schematic drawings and diagrams:
   1. Modify drawings to delete information which is not applicable to the work.
   2. Supplement standard information to provide additional information specifically applicable to the work.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data:
   1. Clearly mark each copy to identify pertinent materials, products or models.
   2. Show dimensions and clearances required.
   3. Show performance characteristics and capacities.
   4. Show wiring or piping diagrams and controls.

C. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to specification section and Article number. 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.

1.5 SAMPLES

A. Office samples shall be of sufficient size and quantity to clearly illustrate:
   1. Functional characteristics of product or material, with integrally related parts and attachment devices.
   2. Full range of color samples.

B. Color Selections & Samples: Provide two (2) samples for the Architect’s review and record. Provide cut sheet when applicable.
   1. Samples for Initial Selection: Submit one (1) full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer’s product line. Architect will return submittal with options selected. In addition to the physical samples required above, submit a .pdf file of photographs of the actual color samples and identifying labels.
   2. Samples for Verification: Submit two (2) full-size units or Sample of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection. In addition to the physical samples required above, submit a .pdf file of photographs of the actual color samples and identifying labels. Architect will retain physical samples.
      a. After Color Board has been delivered to the project site, submit one (1) sample for verification in lieu of two (2). One will be retained by Contractor for mounting on Color Board after approval by Architect.

C. Field Samples and Mock-ups:
   1. Erect at project site at location acceptable to Architect.
   2. Construct each sample or mock-up complete, including work of all trades required in finish work.
   3. Install each sample complete and finished. Acceptable finishes in place may be retained in completed work.

D. Digital Samples: In addition to the physical Office Samples and Field Samples/Mock-ups, submit a .pdf file of photographs of the actual samples/mock-ups.

E. Submit full range of manufacturer's standard finishes except when more restrictive requirements are specified, indicating colors, textures and patterns, for Architect selection.

F. Submit samples to illustrate functional characteristics of products, including parts and attachments.

G. Approved samples which may be used in the work are indicated in the specification section.

H. Label each sample with identification required for transmittal letter.

1.6 CONTRACTOR REVIEW

A. Review submittals prior to transmittal; determine and verify field measurements, field construction criteria, quantities and details, manufacturer's catalog numbers and conformance of submittal with requirements of Contract Documents.

B. Coordinate submittals with requirements of work and of Contract Documents.

C. Sign or initial in a rubber-stamped review block format, each sheet of shop drawings and product data and each sample label to certify compliance with requirements of Contract Documents. Notify Architect in writing at time of submittal, of any deviations from requirements of Contract Documents.

D. Do not fabricate products or begin work which requires submittals until return of submittal with Architect acceptance.

E. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittals.

F. Contractor's responsibility for deviations in submittals from requirements of contract documents is not relieved by Architect's review of submittals, unless Architect gives specific written acceptance of deviations. Architect will review submittals for general conformance to design intent only.

1.7 SUBMISSION REQUIREMENTS

A. Submit Shop Drawings and Product Data as soon as practicable after award of contract but not later than 30 calendar days before dates reviewed submittals will be needed.

B. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
   1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Resubmittal Review: Allow 10 working days for review of each resubmittal.

C. Submit all office samples as soon as practicable but not later than **60 or 20** days after award of contract in order to facilitate color selections and coordination of the various materials. Final color selections and release of shop drawings contingent upon color selection will not be made until all office samples have been submitted, coordinated and approved.
   1. Color Board shall be delivered to the project site after 60 days. Contractor is responsible for updating color board with samples submitted by Contractor and approved by Architect after 60 days.

D. Digital Submittals: Submit to the Architect and Program Manager, or applicable consultant, shop drawings, product data, and samples required by specification sections. Do not submit illegible fax copies nor carbon copies of shop drawings and product data.
   1. The submittals shall be logged in by the General Contractor and tracked using the “Submittal” feature in the Owner’s project management program. All submittals shall be submitted in .pdf format.
      a. Submittals 8-1/2" x 11" and/or 11" x 17" and greater than 50 pages: Provide digital copy for the Architect’s records.
      b. Large Format Drawings (larger than 11 x 17): Provide digital copy for the Architect’s records.
   2. Architect will indicate, via markup on each digital submittal, the appropriate action, then return submittal via the Owner’s project management program.
   3. Submittals to be reviewed by consultants shall be submitted directly to the applicable consultant via Owner’s project management software with a copy simultaneously sent to the Architect. Submittals will be reviewed by the consultant and then delivered/transmitted to the Architect for his review prior to transmitting them to the contractor. Submittals to be reviewed by the testing lab shall be handled in the same manner.
   4. Color Selections & Samples: Reference “Samples” Article within this specification section.
   5. Submit digital copies of shop drawings to the Program Manager for review and digital submittal is to be transmitted simultaneously to the Architect. Direct transmittal by the Contractor to the consultant will not be permitted. Submittals will be reviewed by the consultant and then delivered to the Architect for his review prior to returning them to the contractor**.**

E. Contractor is responsible for the costs associated with the digital delivery of all submittals, and hard copy where required, to the Architect and the Architect's consultants and retrieval of all submittals from the Architect, when necessary.

F. Accompany submittals with transmittal letter containing:
1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Identification of specification section and submittal numbers.
5. The number of each shop drawing, product data and sample submitted.
6. Notification of deviations from contract documents.
7. Other pertinent data.

G. Submittals shall include:
1. Date and revision dates.
2. Project title and number.
3. Names of Architect, Contractor, subcontractor, supplier and manufacturer.
4. Identification of product or material and specification section number.
5. Relation to adjacent structure, materials or other critical features.
6. Field dimensions, clearly identified as such.
7. Applicable reference standards.
8. A blank space 3" x 4" for Architect's stamp.
9. Identification of deviations from contract documents.
10. Contractor's stamp, initialed or signed, certifying to review of submittal, verification of field measurements, compliance with contract documents and coordination with requirements of the work. Note: Absence of the Contractor's stamp shall constitute grounds for rejection of the submittal until such time as the submittal has been processed in accordance with this requirement.
11. Other pertinent data required by specifications.

1.8 RE-SUBMISSION REQUIREMENTS

A. Re-submission: For shop drawings and product data not approved by Architect, make corrections and changes in submittals required by Architect and re-submit until approved.
1. The digital re-submission shall be logged in using the “Resubmit” feature in the Owner’s project management program.

B. Shop Drawings:
1. Revise initial drawings and re-submit as specified for initial submittal.
2. Indicate on drawings any changes which have been made, other than those requested by Architect.

C. Product Data and Samples: Submit new data and samples as specified for initial submittal.

1.9 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Distribute reviewed submittal of shop drawings and product data which carry Architect's stamp as follows: Contractor's file, project site file, record documents file, other prime contractors.

B. Keep and maintain a full set of submittals throughout the construction phase to be submitted to the Architect with other Close-out documents for delivery to the Owner for his permanent record. Set of submittals shall be delivered to the Architect in cardboard file boxes with string and button type closures. Organize submittals by CSI divisions, utilizing neatly labeled pressboard dividers to separate the sections. Neatly label short end of box with project name, contents and duration of construction.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 CODES

A. Where references are made on drawings or specifications to codes, they shall be considered an integral part of the contract documents as minimum standards. Nothing contained in the contract documents shall be so construed as to be in conflict with any law, bylaw or regulation of the municipal, state, federal or other authorities having jurisdiction.

B. Perform work in compliance with all Montgomery County ordinances and requirements.

1.2 GOVERNING LAWS

A. Additional information with legal implications regarding applicable governing laws and jurisdictions can be found in the conditions of the contract.

1.3 PERMITTING

A. Contractor shall, without additional expense to Owner, obtain necessary licenses and permits, and be responsible for complying with any federal, state, county and municipal laws, codes and regulations applicable to the performance of the work, including, but not limited to, any laws or regulations requiring the use of licensed contractors to perform parts of the work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 INDUSTRY STANDARDS

A. Applicability of Standards: Unless 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 to the extent referenced. Such standards are made a part of the contract documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the contract documents.

C. Copies of Standards: Each entity engaged in construction on project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the contract documents.
1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities Available from Access Board www.access-board.gov	800.872.2253 202.272.0080
CRD	Handbook for Concrete and Cement Available from Army Corps of Engineers Waterway Experiment Station http://www.erdc.usace.army.mil/	601.634.2355
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point www.dodssp.daps.dla.mil	215.697.6257
	Available from General Services Administration www.gsa.gov	202.501.1021
	Available from National Institute of Building Sciences www.nibs.org	202.289.7800
ICC-ES	ICC Evaluation Services, Inc. www.icc-es.org	800.423.6587 562.699.0543
TAS	Texas Accessibility Standards P.O. Box 12157 Austin, TX 78711 www.license.state.tx.us/ab/abtas.htm	512.463.3211

1.2 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

AA	Aluminum Association, Inc. (The) www.aluminum.org	703.358.2960
AAMA	American Architectural Manufacturers Association www.aamanet.org	847.303.5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	202.624.5800
ACI	ACI International (American Concrete Institute) www.aci-int.org (www.concrete.org)	248.848.3700
AGA	American Gas Association www.aga.org	202.824.7000
AISC	American Institute of Steel Construction www.aisc.org	800.644.2400 312.670.2400
AISI	American Iron and Steel Institute www.steel.org	202.452.7100
ANSI	American National Standards Institute www.ansi.org	202.293.8020
APA	APA-The Engineered Wood Association www.apawood.org	253.565.6600
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers www.ashrae.org	404.636.8400
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	610.832.9585
AWI	Architectural Woodwork Institute www.awinet.org	571.323.3636
AWPA	American Wood Protection Association www.awpa.com	205.733.4077
AWS	American Welding Society www.aws.org	800.443.9353 305.443.9353
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	212.297.2122
BIA	Brick Industry Association (The) www.gobrick.com	703.620.0010
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	630.584.1919
CLFMI	Chain Link Fence Manufacturers Institute	301.596.2583

	www.chainlinkinfo.org	
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	847.517.1200
DHI	Door and Hardware Institute www.dhi.org	703.222.2010
FM	Factory Mutual System (See FMG)	
FMG	FM Global (Formerly: FM - Factory Mutual System) www.fmglobal.com	401.275.3000
GA	Gypsum Association www.gypsum.org	301.277.8686
GANA	Glass Association of North America www.glasswebsite.com	785.271.0208
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	703.435.2900
IGCC	Insulating Glass Certification Council www.igcc.org	315.646.2234
IGMA	Insulating Glass Manufacturers Alliance (The) www.igmaonline.org	613.233.1510
MBMA	Metal Building Manufacturers Association www.mbma.com	216.241.7333
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	888.480.9138
MFMA	Metal Framing Manufacturers Association www.metalframingmfg.org	312.644.6610
MIA	Marble Institute of America www.marble-institute.com	440.250.9222
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	630.942.6591
NCMA	National Concrete Masonry Association www.ncma.org	703.713.1900
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	207.829.6901
NEMA	National Electrical Manufacturers Association www.nema.org	703.841.3200
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	800.344-3555 617.770-3000
NFRC	National Fenestration Rating Council	301.589.1776

	www.nfrc.org	
NHLA	National Hardwood Lumber Association www.nhla.com	800.933.0318 901.377.1818
NLGA	National Lumber Grades Authority www.nlga.org	604.524.2393
NOFMA	National Oak Flooring Manufacturers Association (The Wood Flooring Manufacturers Association) www.nofma.org	901.526.5016
NRCA	National Roofing Contractors Association www.nrca.net	800.323.9545 847.299.9070
NTMA	National Terrazzo & Mosaic Association, Inc. www.ntma.com	800.323.9736 540.751.0930
NWWDA	National Wood Window and Door Association (See WDMA)	
PCI	Precast/Prestressed Concrete Institute www.pci.org	312.786.0300
PDCA	Painting and Decorating Contractors of America www.pdca.org	800.332.7322 314.514.7322
SDI	Steel Deck Institute www.sdi.org	847.458.4647
SDI	Steel Door Institute www.steeldoor.org	440.899.0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	516.294.5424
SGCC	Safety Glazing Certification Council www.sgcc.org	315.646.2234
SIGMA	Sealed Insulating Glass Manufacturers Association (See IGMA)	
SJI	Steel Joist Institute www.steeljoist.org	843.626.1995
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	703.803.2980
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	850.434.2611
TCNA	Tile Council of America, Inc. www.tileusa.com	864.646.8453
TPI	Truss Plate Institute, Inc. www.tpinst.org	703.683.1010
UL	Underwriters Laboratories Inc. www.ul.com	800.285.4476 847.272.8800
USGBC	U.S. Green Building Council	800.795.1747

	www.usgbc.org	202.828.7422
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	800.283.1486 503.639.0651
WDMA	Window & Door Manufacturers Association (Formerly: NWWA - National Wood Window and Door Association) www.wdma.com	800.223.2301 312.321.6802
WI	Woodwork Institute www.woodworkinstitute.com	916.372.9943
WWPA	Western Wood Products Association www.wwpa.org	503.224.3930

B. Code Agencies: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

BOCA	BOCA International, Inc. (See ICC)	
CABO	Council of American Building Officials (See ICC)	
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	909.472.4100
ICBO	International Conference of Building Officials (See ICC)	
ICC	International Code Council (Formerly: CABO - Council of American Building Officials) www.iccsafe.org	888.422.7233 703.931.4533
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	

C. Federal Government Agencies: Where abbreviations and acronyms are used in specifications or other contract documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and web-site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the contract documents.

CE	Army Corps of Engineers www.usace.army.mil	
CPSC	Consumer Product Safety Commission www.cpsc.gov	800.638.2772 301.504.6816
EPA	Environmental Protection Agency www.epa.gov	202.272.0167
OSHA	Occupational Safety & Health Administration www.osha.gov	800.321.6742 202.693.1999

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 42 16

DEFINITIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. “Furnish": Supply and deliver to project site, ready for unloading, unpacking, assembly, installation, and similar operations.

B. "Install": Operations at project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

C. "Product": Materials, systems and equipment.

D. “Project Manual”: Volume assembled for the Work which may include the bidding requirements, sample forms, conditions of the contract, and specifications.

E. "Provide": Furnish and install, complete and ready for the intended use.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Quality control of products and workmanship.
2. Manufacturer's instructions.
3. Manufacturer's certificates and field services.
4. Mockups.

B. Related Requirements:
1. Section 01 33 23 - Shop Drawings, Product Data, and Samples: Field samples. Submittal of manufacturer's instructions.
2. Section 01 42 00 - References.
3. Section 01 45 23 - Testing and Inspection Services.
4. Section 01 62 00 - Product Options.
5. Individual Specifications Sections: Mockups required.

1.2 DESCRIPTION

A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, workmanship, and site conditions, to produce work in accordance with contract documents.

1.3 WORKMANSHIP

A. Comply with industry standards of the region except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.

B. Provide suitably qualified personnel to produce work of specified quality.

C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking.

D. Provide finishes to match approved samples.

1.4 MANUFACTURER'S INSTRUCTIONS

A. Require compliance 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 Specifications section, submit manufacturer's certificate, in duplicate, certifying that products meet or exceed specified requirements, executed by responsible officer.

1.6 MANUFACTURER'S FIELD SERVICES

A. When required in individual Specifications section, have manufacturer or his authorized representative provide qualified representative to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment test, adjust, and balance of equipment as applicable, and to make written report of observations and recommendations to Architect.

B. Individuals to report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

C. Submit report in duplicate within 30 days of observation to Architect/Engineer for review.

1.7 MOCKUPS

A. Tests will be performed under provisions of SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

B. Assemble and erect complete, with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Acceptable mockups in place may be retained in completed work.

1.8 FIELD SAMPLES

A. Install field samples at the site as required by individual specification sections for review.

B. Acceptable samples represent a quality level for the work.

C. Where field sample is specified in individual sections to be removed, clear area after field sample has been accepted by Architect/Engineer.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 45 23

TESTING AND INSPECTION SERVICES (BY OWNER)

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included: Owner provided materials testing laboratory services.

B. Related Requirements:
1. Document 00 31 32 - Geotechnical Data.
2. Terms and Conditions: Inspections, testing, and approvals required by public authorities.
3. Section 01 45 00 - Contract Quality Control: Manufacturer's certificates.
4. Section 01 78 39 - Project Record Documents.
5. Individual Specifications Sections: Inspections and tests required, and standards for testing.

1.2 SELECTION AND PAYMENT

A. Owner will employ services of an independent materials testing laboratory to perform specified inspection and testing and will pay for these services directly to the testing laboratory.

B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of contract documents. Contractor will pay all testing required by local authorities having jurisdiction.

1.3 QUALITY ASSURANCE

A. Laboratory shall comply with requirements of ASTM E 329 and ASTM D 3740 and provide certifications to this effect.

B. Laboratory shall maintain a full-time registered Engineer on staff to review specific tests required by this specification.

C. Laboratory shall be authorized to operate in State in which project is located.

D. Testing equipment shall be calibrated to ensure accurate results and values in order to ensure that test results are true and valid, and at intervals with devices of an accuracy traceable to either NBS Standards or accepted values of natural physical constants.

1.4 LABORATORY RESPONSIBILITIES

A. Provide qualified personnel at site after due notice from the contractor; cooperate with Architect, Contractor, and appropriate public authorities having jurisdiction in performance of services.

B. Perform specified inspection, sampling, and testing of products in accordance with latest, up-to-date standards.

C. Ascertain compliance of materials and mixes with requirements of contract documents.

D. Promptly notify Architect, appropriate consultants, Contractor, Owner, and authority having jurisdiction of observed irregularities or non-conformance of work or products.

E. Perform additional inspections and tests required by Architect, Owner, Contractor, or authority having jurisdiction.

1.5 LABORATORY REPORTS

A. After each inspection and test, promptly submit two copies of laboratory report to Architect, one to applicable consultant, one to Owner, one to Contractor, and one to City. Include: Date issued, project title and number, name of inspector, date and time of sampling or inspection, weather conditions, identification of product and specifications section, location in the project, type of inspection or test, date of test, results of tests, and specific indication of conformance, or lack of such, with contract documents. When requested by Architect/Engineer, provide interpretation of test results.

1.6 LIMITS ON TESTING LABORATORY AUTHORITY

A. Laboratory may not release, revoke, alter, or enlarge on requirements of contract documents.

B. Laboratory may not approve or accept any portion of the work.

C. Laboratory may not assume any duties of Contractor.

D. Laboratory has no authority to stop work.

1.7 CONTRACTOR RESPONSIBILITIES

A. Deliver to laboratory at designated location adequate samples of materials proposed to be used which require testing, together with proposed mix designs.

B. Cooperate with laboratory personnel and ensure ready access to work and to manufacturer's facilities, if requested by testing lab.

C. Provide incidental labor and facilities for access to work to be tested, to obtain and handle samples at the site, or at source of products to be tested, in order to facilitate tests and inspections, and for storage and curing of test samples.

D. Notify laboratory of material sources and furnish lab-determined necessary quantities of representative samples of materials proposed for use which are required to be tested.

E. Notify Architect and laboratory 24 hours prior to expected time for operations requiring inspection and testing services. Cancel notifications in a timely manner if items or systems are not ready for inspection as intended. Reimburse Owner for trip charges when cancellation notifications are not made in a timely fashion.

F. Advise laboratory in a timely fashion to complete required inspection and testing prior to subsequent work being performed.

G. Reimburse Owner for all subsequent re-testing of products or systems found to be defective or otherwise not in accordance with specification requirements, and for any overtime pay required as a result of any inspection requirements that may fall outside of normal job-site weekday work schedule. Remove rejected products or work and replace with products or work of specified quality.

H. Notification of Source Change: The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and testing laboratory when the source of any material is changed after the original tests or inspections have been made.

PART 2 - PRODUCTS – Not used.

PART 3 - EXECUTION

3.1 EARTHWORK (SITE GENERAL)

A. Make necessary soil tests (Atterberg Limit Series ASTM D 4318 and ASTM D 698 Standard Proctor) to determine moisture content and density of existing subgrade. Perform necessary soil tests (Atterberg Limit Series and ASTM D 698 Standard Proctor for each type of imported fill) to determine the moisture content and to inspect and test the placement of additional fill lifts to verify that all fill materials used are in accordance with the specifications for that use. Perform one field density test (ASTM D 2922 and ASTM D 3017) per 5,000 sq. ft. of site area in the area affected on each lift prior to placement of additional fill material.

B. Imported Topsoil Tests: Testing for topsoil quality compliance shall be performed by the Testing Laboratory.

3.2 PAVING OR SPECIAL SURFACE SUBGRADE PREPARATION

A. Perform one subgrade in-place density test per 7,500 sq. ft. of subgrade, after subgrade preparation, in accordance with ASTM D 2922 and ASTM D 3017. Perform tests within 48 hours of pavement construction.

B. Pulverization tests on lime subgrade, TEX101E, Part III, at same frequency as density tests.

3.3 BUILDING SUBGRADE PREPARATION

A. Make necessary soil tests (Atterberg Limit Series and ASTM D 698 Standard Proctor for each type of fill) to determine the moisture content and density of existing subgrade and inspect and test the placement of additional fill lifts to verify that all fill materials used are in accordance with the specifications for that use. Perform one field density test (ASTM D 2922 and ASTM D 3017) for each 5,000 sq.ft. of area within the building footprint on each lift prior to placement of additional fill material.

3.4 DRILLED CONCRETE PIERS

A. The independent testing laboratory shall provide the services of their registered geotechnical engineer at the initiation of the on-site pier drilling operations to determine the appropriate bearing material into which the piers are to be founded. Written documentation of the "determination" shall be prepared and forwarded to the Owner, Architect, and Contractor.

B. Make on-site full-time inspections of the pier drilling operation for each pier drilled and placed to verify that the proper strata and penetration, or depth, has been attained, and determine that shafts are properly clean and dry before placing concrete.

C. Maintain a pier log for each pier showing design requirements and actual in place size and depth, in accordance with example noted in Specification SECTION 31 63 29 - DRILLED CONCRETE PIERS.

D. Verify that the excavation is of the proper size and adequately clean and dry.

E. Verify that each shaft is founded at a depth in accordance with the geotechnical report, existing on-site conditions that may be encountered, and at the proper bearing strata.

F. Verify that the reinforcing steel and concrete are properly placed in accordance with other testing provisions specified herein.

G. Notify the Architect and Contractor if soil or water conditions may require casing of piers.

H. Inspection reports of pier drilling shall contain the following:
1. Pier Mark.
2. Pier Depth.
3. Depth of penetration into bearing strata.
4. Plumbness deviation.
5. Description of unusual conditions encountered, including groundwater.
6. Record of deviations from contract document requirements.
7. Other requirements, as defined in SECTION 31 63 29 - DRILLED CONCRETE PIERS.

3.5 FORMWORK, REINFORCING STEEL AND INSERTS

A. Make general inspection of formwork.

B. Prior to each concrete pour, inspect fabrication and bending of bars, bar sizes, spacing, placement and tying in accordance with ACI 315.

C. Prior to each concrete pour, inspect positioning of steel inserts and assemblies, sizes, and spacing, and inspect fusion-welded anchors and sheer connectors.

3.6 CAST-IN-PLACE CONCRETE

A. Design Mixes:
1. At the beginning of the work, Contractor shall submit proposed concrete mixes for review by the Architect, structural engineering consultant, and testing laboratory, including the sieve analysis of fine and course aggregate ASTM C 136, dry rodded weight of coarse aggregate - ASTM C 29, and the specific gravity (bulk saturated surface dry), of fine and coarse aggregates ASTM C 127 and C 128.
2. The testing laboratory will submit their findings to the structural consultant, who will subsequently forward this information, with their review of the submittals, to the Architect.
3. Contractor shall not mix concrete for placing in the work until confirmation laboratory reports are supplied to reflect that each proposed mix will develop the strength required. Successful past history in accordance with ACI 318 will be satisfactory.

B. Test Cylinders: Make at least one test of each day's pouring of concrete or each 100 cubic yards, whichever is the least, on each different portion or section of the work. Mold and cure specimens in accordance with ASTM C 31, and test in accordance with ASTM C 39. Test cylinders shall be made and tested by the laboratory. Footings, walls, and floor systems constitute different sections. Each test shall consist of four specimens, one of which shall be broken at seven days, two at 28 days and one held in reserve. Determine temperature and air content for each set of test cylinders in accordance with ASTM C 231.

C. Field Quality Control:
1. Determine slump for each concrete strength test and whenever consistency of concrete varies, in accordance with ASTM C 143.
2. Monitor and record addition of water to concrete and length of time concrete is allowed to remain in truck.
3. Verify delivery tickets indicating class of concrete, amount of water added during initial batching, and time initial batching occurred.
4. Monitor work being performed in accordance with ACI (American Concrete Institute) recommendations as a standard of quality.
5. Reference SECTION 03 30 00 - CAST-IN-PLACE CONCRETE for additional requirements.

D. Source Quality Control: An independent testing laboratory representative shall periodically inspect and control concrete mixing and loading of transit mix trucks at batch plant at intervals appropriate to monitor quality of material issued on job.

3.7 MORTAR, GROUT, AND MASONRY REINFORCEMENT

A. Coordinate with Owner’s testing laboratory to provide periodic inspection of the following task:
1. As masonry construction begins, the following shall be verified to ensure compliance:
a. Proportions of site prepared mortar.
b. Construction of mortar joints.
c. Location of reinforcement and connectors.

2. The inspection program shall verify:
   a. Size and location of structural elements.
   b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
   c. Specified size, grade, and type of reinforcement.
   d. Protection of masonry during cold weather (temperature below 40°F.) or hot weather (temperature above 90°F.).
3. Prior to grouting, the following shall be verified to ensure compliance:
   a. Grout space is clean.
   b. Placement of reinforcement and connectors.
   c. Proportions of site-prepared grout.
   d. Construction of mortar joints.

B. Coordinate with Owner's testing laboratory to provide continuous inspection of the following task:
   1. Grout placement shall be verified to ensure compliance with code and construction document provisions.

3.8 METAL DECKING

A. Qualification of Welders: Qualify the welding process and all welders (at Contractor expense), and periodically monitor the work in accordance with the requirements of AWS D1.3.

B. Testing Laboratory shall inspect steel decking to ensure the material and installation is in accordance with the specifications and shop drawings.

3.9 OTHER WORK REQUIRING TESTS

A. Refer to individual sections covered under Divisions 22, 23, and 26 for other work requiring tests by independent testing laboratory.

END OF SECTION

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SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 GENERAL

A. Provide temporary facilities and controls needed for the work including, but not limited to those described in the Articles below.

B. Maintain temporary facilities and controls as long as needed for safe and proper completion of the work.

1.2 ACCESS

A. Provide adequate access to and temporary roads to the site of the building if required for the prosecution of the work.

B. Provide and maintain access to fire hydrants, free of obstructions.

1.3 FIELD OFFICE

A. Provide and maintain a weathertight temporary field office equipped with adequate illumination; with glazed operable windows; with smooth tables for perusal of drawings and specifications; and with metal legal size four-drawer filing cabinet. During cold weather the field offices shall be equipped with a heating device to maintain 65°F. temperature during the work day. During hot weather the offices shall be equipped with an air conditioning device to maintain temperature below 80°F. Provide and pay for fuel and electric energy. In addition to the above listed equipment, provide a space to accommodate the site meetings and have a layout/conference table at 28" height and chairs for 12 people. Upon completion of the project, remove offices from the premises.

1.4 TELEPHONES AND ELECTRONIC COMMUNICATION SERVICE

A. Provide telephones/mobile phones in the field office. Telephone shall be in operation from the commencement of work until the acceptance of the building. Contractor shall pay for installation, maintenance, and removal of telephones, lines and for all use charges.

B. Electronic Communication Service: Provide a computer, printer, high-speed data connection, and internet service as required for the Contractor to maintain internet access and e-mail correspondence.
   1. The Contractor shall utilize Owner’s project management system for all formal and informal correspondence with the Architect and Architect's Consultants, including E-Mails, Requests for Information, Proposals, Submittals, Submittal Transmittals, Meeting Minutes (for regularly scheduled meetings), and Warranty Responses (if warranty items are submitted in the system). In addition, Subcontractor Lists, Project Schedules, Schedule of Values and other documents requiring submission shall be uploaded in pdf, Word, or Excel format by the Contractor to the appropriate location in system.
   2. Contractor shall pay for installation, maintenance, and removal of high-speed data connection and for all use charges.

1.5 TEMPORARY ELECTRICAL SERVICE

A. The contractor shall provide, install, and maintain separate temporary electrical service, including a separate temporary electric meter and temporary pole, if required. The contractor shall be responsible for contacting and coordinating with the local utility company for the installation, maintenance and removal of the temporary service. This service shall stay in-place until Substantial Completion. The contractor shall pay for all costs associated with this separate temporary electrical service.
   1. Despite partial Owner occupancy, the Contractor shall remain responsible for portions of the work which have not attained Substantial Completion and for which a Substantial Completion Certificate, which shall designate the date on which the Owner shall become responsible for utilities, maintenance, security, damage to the work and insurance, has not been executed.

B. Provide and maintain temporary electric power to points in the building convenient for and available to all trades, including mechanical and other contracts, so that power can be secured anywhere in the building with no more than a 100 ft. extension cord. Energy charges shall be paid by the Contractor.

1.6 TEMPORARY LIGHTING

A. Provide and maintain temporary lighting inside the building for safe and adequate working conditions throughout all areas where work of any kind is being performed. Provide at least 1/2 watt of incandescent lighting for each square foot of space. Where practical, place temporary lights in the locations where the permanent lighting fixtures are to be installed.

1.7 TEMPORARY HEAT

A. Provide necessary heat during the course of construction, including equipment, fuel and attendance where required. Equipment for temporary heating shall be of a non-smudging type. The permanent heating system may be used for temporary heat, when installed. Upon completion and before acceptance of the building, Contractor shall repair all damage caused by such temporary use and shall clean all filters.

B. When the outside temperature is below freezing, inside of the building shall be kept at or above 40°F. at all times. While painting and finishing are in progress, the temperature shall be kept at or above 60°F. Contractor shall make good all damage caused by insufficient heat.

1.8 TEMPORARY VENTILATION

A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.9 TEMPORARY WATER SERVICE

A. Provide and maintain a temporary water supply during the course of construction and pay water bill and meter installation or "tap" fee, if any. Include necessary piping and hose connections. Take precautions to avoid spattering and spilling water in the building.

1.10 TEMPORARY SANITARY FACILITIES

A. Provide and maintain adequate sanitary toilet facilities on the project site. The toilet facilities shall meet the requirements of the public authorities having jurisdiction and their use strictly enforced. Sanitary sewer "tap" fee and monthly use fees, if any, shall be paid by Contractor if temporary facilities are connected to city sanitary sewer.

1.11 REFUSE

A. The Contractor shall provide refuse removal service at all times.

1.12 PROTECTIVE FACILITIES

A. Provide and maintain temporary guardrails, handrails and covers for floor, roof and wall openings, vertical shafts and stairways. If movement of the protective facilities is required by a subcontractor to perform his work, it will be the responsibility of that subcontractor to give prior notification to the Contractor and to replace the protective facilities in a satisfactory manner.

B. Provide and maintain, as per Montgomery County requirements, fire lane(s) and other required fire protection at the appropriate time and sequence of construction.

1.13 BARRICADES

A. Provide and maintain lighted barricades and fences for the public protection in accordance with requirements of the local county ordinances.

1.14 TEMPORARY FENCING

A. Provide and maintain for the duration of construction a temporary fence of design and type needed to prevent entry onto the work by the public.

1.15 TEMPORARY FIRE PROTECTION

A. Contractor shall provide adequate fire extinguishers on the premises during the course of construction, of the type and size recommended to control fires, which may result from the particular work being performed in accordance with the local fire marshal and fire codes.

B. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of ignition for possible fires.
   1. Keep work area free of combustible material.
   2. A fire watch consisting of at least one man furnished by Contractor with a fire extinguisher in hand and with no other assigned duties, shall be posted to stand by and observe for potential hazards while welding or cutting is being done. Equip fire watch with suitable personal eye protection and fire extinguishers.
   3. At completion of work operations, immediately inspect work and adjacent area for hazards. Re-inspect work for hazards at 1/2 hour and at one hour after completion of welding and cutting operations.

C. No smoking shall be allowed within the building or on the site. Post NO SMOKING signs in areas where work is in progress.

1.16 ENCLOSURES

A. Provide temporary weathertight closures of openings in exterior surfaces to provide acceptable working conditions and protection for materials, to allow for temporary heating, and to prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

1.17 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide and operate pumping equipment.

B. Protect site from puddling or running water.

1.18 CLEANING DURING CONSTRUCTION

A. Control accumulation of waste materials and rubbish; periodically dispose of off site.

B. Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

C. Refer to SECTION 01 74 13 - PROGRESS CLEANING for additional cleaning requirements.

1.19 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary materials, equipment, services, and construction prior to substantial completion inspection.
   1. Temporary electrical service shall stay in-place until Substantial Completion and then shall be removed.

B. Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations to a depth of 2'; grade site as indicated. Restore existing facilities used during construction to specified, or to original, condition.

1.20 PROJECT IDENTIFICATION SIGNS

A. Furnish and erect a project sign, exterior grade plywood, in conformance with sign detail supplied by the Architect. Support on posts of framing of treated wood or steel.

B. Erect sign within 30 days of start of construction and maintain in good condition until completion of project. Sign shall be located as directed by the Architect.

C. No other signs or advertising of any kind, except precautionary warning signs, will be permitted.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 55 13.10

STABILIZED CONSTRUCTION ENTRANCE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Installation of erosion and sediment control for stabilized construction exits used during construction and until final development of the site.

1.2 SUBMITTALS

A. Manufacturer's catalog sheets and other product data on geotextile fabric.

B. Sieve analysis of aggregates conforming to requirements of this Specification.

1.3 UNIT PRICES

A. Unless indicated in the Unit Price Schedule as a pay item, no separate payment will be made for work performed under this Section. Include cost of work performed under this Section in pay items for which this work is a component.

B. When indicated in the Unit Price Schedule, include stabilized exits under payment for Street Cleaning as Required by NPDES, including stabilized construction roads, parking areas, exits, and truck washing areas will include and be full compensation for all labor, equipment, materials, supervision, and all incidental expenses for construction of these items, complete in place, including, but not limited to, embankment and excavation, maintenance requirements, repair and replacement of damaged sections, removal of sediment deposits, redressing of aggregates and stones, cleaning of streets, and removal of erosion and sediment control systems at the end of construction.

1.4 REFERENCES

A. ASTM D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

PART 2 P R O D U C T S

2.1 GEOTEXTILE FABRIC

A. Provide woven or nonwoven geotextile fabric made of either polypropylene, polyethylene, ethylene, or polyamide material.

B. 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.

C. 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 6 months of expected usable life at a temperature range of 0°F to 120°F.

D. Representative Manufacturers: Mirafi, Inc., or equal.

2.2 COARSE AGGREGATES

A. Coarse aggregate shall consist of crushed stone, gravel, crushed blast furnace slag, or a combination of these materials. 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
¾”	60 - 80
No. 4	95 - 100

PART 3 E X E C U T I O N

3.1 PREPARATION AND INSTALLATION

A. If necessary to keep the street clean of mud carried by construction vehicles and equipment, Contractor shall provide stabilized construction roads and exits at the construction, staging, parking, storage, and disposal areas. Such erosion and sediment controls shall be constructed in accordance with the requirements shown on the Drawings and specified in this Section.

B. No clearing and grubbing or rough cutting shall be permitted until erosion and sediment control systems are in place, other than as specifically directed by the Owner’s Representative to allow soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within the project site until acceptance of the project or until directed by the Owner’s Representative to remove and discard the existing system.

D. Regularly inspect and repair or replace components of stabilized construction exits. Unless otherwise directed, maintain the stabilized construction roads and exits until the project is accepted by the Owner. Remove stabilized construction roads and exits promptly when directed by the Owner’s Representative. Discard removed materials off site in accordance with the requirements of Division 1.

E. Remove sediment deposits and dispose of them at the designated spoil site for the project. If a project spoil site is not designated on the Drawings, dispose of sediment off site at location not in or adjacent to a stream or floodplain. Off-site disposal is 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 a 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.

F. Equipment and vehicles shall be prohibited by the Contractor from maneuvering on areas outside of dedicated rights-of-way and easements for construction. Damage caused by construction traffic to erosion and sediment control systems shall be repaired immediately.

G. Conduct all construction operation under this Contract in conformance with the erosion control practices described in Division 1.

3.2 CONSTRUCTION METHODS

A. Provide stabilized access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes where shown on Drawings.

B. Provide stabilized construction exits, and truck washing areas when approved by Owner's Representative, of the sizes and locations where shown on Drawings or as specified in this Section.

C. Vehicles leaving construction areas shall have their tires cleaned to remove sediment prior to entrance onto public right-of-way. 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.

D. Details for stabilized construction exit are shown on the Drawings. Construction of all other stabilized areas shall be to the same requirements. Roadway width shall be at least 14 feet for one-way traffic and 20 feet for two-way traffic and shall be sufficient for all ingress and egress. Furnish and place geotextile fabric as a permeable separator to prevent mixing of coarse aggregate with underlaying soil. Exposure of geotextile fabric to the elements between laydown and cover shall be a maximum of 14 days to minimize damage potential.

E. Roads and parking areas shall be graded to provide sufficient drainage away from stabilized areas. Use sandbags, gravel, boards, or similar methods to prevent sediment from entering public right-of-way, receiving stream or storm water conveyance system.

F. 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 control measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto public right-of-way shall be removed immediately.

G. The length of the stabilized area shall be as shown on the Drawings, but not less than 50 feet. The thickness shall not be less than 8 inches. The width shall not be less than the full width of all points of ingress or regress.

H. Stabilization for other areas shall have the same coarse aggregate, thickness, and width requirements as the stabilized construction exit, except where shown otherwise on the Drawings.

I. Stabilized area may be widened or lengthened to accommodate truck washing area when authorized by Owner's Representative.

J. Alternative methods of construction may be utilized when shown on Drawings, or when approved by the City Engineer. These methods 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.

END OF SECTION 01 55 13.10

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SECTION 01 55 26

TRAFFIC CONTROL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Requirements for signs, signals, control devices, traffic barriers, flares, lights and traffic signals; construction parking control, designated haul routes, and bridging of trenches and excavations.

B. Qualifications and requirements for use of flagmen.

1.2 MEASUREMENT AND PAYMENT

A. Unit Price Contracts.

1. Traffic control and regulation. Payment for traffic control and regulation is on a lump sum basis. Include preparation and submittal of traffic control plan if different than shown on Drawings, and provision of traffic control devices, equipment, and personnel necessary to protect the Work and public. Payment will be based on Contractor's Schedule of Values for traffic control and regulation.
2. Flagmen. Payment for flagmen is on a lump sum basis. Partial payments will be based on Contractor's Schedule of Values for flagmen.
3. New Portable Concrete Low Profile Traffic Barrier Provided. Payment is on a unit price basis for each linear foot of low profile traffic barrier provided, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
4. Portable Concrete Low Profile Traffic Barrier picked up from Stockpile. Payment is on a unit price basis for each linear foot of low profile traffic barrier picked up from designated stockpile, moved onto the project, set at location and connected together.
5. Portable Concrete Low Profile Traffic Barrier Installed. Payment is on a unit price basis for each linear foot of low profile traffic barrier delivered to the project location, installed with hardware assemblies and connected together in accordance with the approved traffic control plan.
6. Portable Concrete Low Profile Traffic Barrier Moved and Reset. Payment is on a unit price basis for each linear foot of low profile traffic barrier disassembled, moved on the project, reset at the new locations and connected together. Include cost to repair roadway in the unit price.
7. Portable Concrete Low Profile Traffic Barrier Removed. Payment is on a unit price basis for each linear foot of low profile traffic barrier removed from the project, including hardware assemblies, and stockpiling at location listed in Division 1. Include cost to repair roadway in the unit price.
8. Refer to Division 1 for unit price procedures.

B. Stipulated Price Contracts. Include payment for work under this section in the total Stipulated Price.

1.3 REFERENCES

A. Texas Manual on Uniform Traffic Control Devices (TMUTCD)

B. Article 4413 (29bb), commonly referred to as Private Investigators and Private Security Agencies Act, and Article 2.12, Texas Code of Criminal Procedure.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Traffic control plan:

1. If using traffic control plan contained in the Contract without modification, submit a letter confirming use of the plan.
2. If using a different traffic control plan, submit the plan for approval. The plan must conform to TMUTCD requirements and be sealed by a Registered Texas Professional Engineer.

C. Submit copies of approved lane closure permits issued by all governmental authorities.

D. Submit Schedules of Values for traffic control plan and flagmen within 30 days following Notice to Proceed.

E. Submit records verifying qualifications of Uniformed Peace Officers and Certified Flagmen proposed for use on the Work.

1.5 FLAGMEN

A. Use Uniformed Peace Officers and Certified Flagmen to control movement of vehicular and pedestrian traffic when construction operations encroach on public traffic lanes.

B. Uniformed Peace Officer: Individual employed full-time as a peace officer who receives separate compensation as a privately employed flagman. Private employment may be an employee-employer relationship or on an individual basis. Flagman may not be in the employ of another peace officer nor be a reserve peace officer.

1. Uniformed Peace Officers may be:
   a. Sheriffs and their deputies;
   b. Constables and deputy constables;
   c. Marshals or police officers of an incorporated city, town or village; or
   d. As otherwise provided by Article 2.12, Code of Criminal Procedure.
2. The Uniformed Peace Officer must be a full-time peace officer, must work a minimum average of 32 paid hours per week, and must be paid a rate not less than the prevailing minimum hourly wage rate set by the federal Wage and Hour Act. The individual must be entitled to vacation, holidays, and insurance and retirement benefits.

C. Certified Flagman: Individual who receives compensation as a flagman and meets the following qualifications:

1. Formally trained and certified in traffic control procedures by the City's E. B. Cape Center.
2. Speaks English. Ability to speak Spanish is desirable but not required.
3. Paid for flagman duty at an hourly rate not less than the wage rate set for Rough Carpenter under the City of Houston's Wage Scale for Engineering Construction.

D. Certified Flagmen must wear a distinctive uniform, bright-colored vest, and be equipped with appropriate flagging and communication devices while at the Work site. They must also have

in their possession while on duty, a proof of training identification card issued by the appropriate training institute.

PART 2 P R O D U C T S

2.1 SIGNS, SIGNALS, AND DEVICES

A. Comply with TMUTCD requirements.

B. Traffic cones and drums, flares and lights: Conform to local jurisdictions' requirements.

2.2 PORTABLE LOW PROFILE CONCRETE BARRIERS

A. The low profile concrete barrier is a patented design. Information concerning this barrier may be obtained from Texas Transportation Institute, Texas A&M University System, College Station, Texas 77843-3135, (409) 845-1712.

PART 3 E X E C U T I O N

3.1 PUBLIC ROADS

A. Submit requests forms for lane closure and sidewalk closure to the appropriate governmental authority at least three working days prior to need for blocking vehicular lanes or sidewalks. Do not block lanes or sidewalks without approved permits.

B. Follow laws and regulations of governing jurisdictions when using public roads. Pay for and obtain permits from jurisdiction before impeding traffic or closing lanes. Coordinate activities with Owner's Representative.

C. Give Owner's Representative one-week notice before implementing approved traffic control phases. Inform local businesses of impending traffic control activities.

D. Notify police department, fire department, METRO, and local schools, churches, and businesses in writing a minimum of five business days prior to beginning work.

E. Maintain 10-foot-wide all-weather lanes adjacent to the Work for emergency vehicle use. Keep all-weather lanes free of construction equipment and debris.

F. Do not to obstruct normal flow of traffic from 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m. on designated major arterials or as directed by Owner's Representative.

G. Maintain local driveway access to residential and commercial properties adjacent to work areas at all times. Use all-weather materials approved by Owner's Representative to maintain temporary driveway access to commercial and residential driveways.

H. Keep streets entering and leaving job site free of excavated material, debris, and foreign material resulting from construction operations in compliance with applicable ordinances.

I. Remove existing signage and striping that conflict with construction activities or that may cause driver confusion.

J. Provide safe access for pedestrians along major cross streets.

K. Alternate closures of cross streets so that two adjacent cross streets are not closed simultaneously.

L. Do not close more than two consecutive esplanade openings at a time without prior approval from Owner's Representative.

3.2 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and the Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

3.3 FLARES AND LIGHTS

A. Provide flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.4 HAUL ROUTES

A. Utilize haul routes designated by authorities or shown on Drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic and minimize interference with public traffic.

3.5 TRAFFIC SIGNS AND SIGNALS

A. Construct necessary traffic control devices for temporary signals required to complete the Work including loop detectors, traffic signal conduits, traffic signal wiring and crosswalk signals. Notify the governmental agency having jurisdiction a minimum of 60 days in advance of need for control boxes and switchgear. The Contractor will pay for all necessary service, programming or adjustments, to signal boxes and switchgear if required during construction.

B. Install and operate traffic control signals to direct and maintain orderly traffic flow in areas under Contractor's control affected by Contractor's operations. Post notices, signs and traffic controls before moving into next phase of traffic control.

C. Relocate traffic signs and signals as the Work progresses to maintain effective traffic control.

D. Unless otherwise approved by Owner's Representative, provide driveway signs with name of business that can be accessed from each crossover. Use two signs for each crossover.

E. Replace existing traffic control devices in Project area.

F. Owner's Representative may direct Contractor to make minor adjustments to traffic control signage to eliminate driver confusion and maintain orderly traffic flow during construction at no additional cost to the Owner.

3.6 BRIDGING TRENCHES AND EXCAVATIONS

A. When necessary, construct bridges over trenches and excavation to permit an unobstructed flow of traffic across construction areas and major drives. Use steel plates of sufficient thickness to support H-20 loading and install to operate with minimum noise.

B. Shore trench or excavation to support bridge and traffic.

C. Secure bridging against displacement with adjustable cleats, angles, bolts or other devices when:

1. Bridging is placed over existing bus routes,
2. More than five percent of daily traffic is comprised of commercial or truck traffic,
3. More than two separate plates are used for bridging, and
4. When bridge is to be used for more than five consecutive days.

D. Extend steel plates used for bridging a minimum of 1 foot beyond edges of trench or excavation. Use temporary paving materials such as premix to feather edges of plates to minimize wheel impact on secured bridging.

3.7 REMOVAL

A. Remove equipment and devices when no longer required.

B. Repair damage caused by installation.

C. Remove post settings to a depth of 2 feet.

3.8 TRAFFIC CONTROL, REGULATION AND DIRECTION

A. Use Flagmen to control, regulate and direct an even flow and movement of vehicular and pedestrian traffic, for periods of time as may be required to provide for public safety and convenience, where:

1. Multi-lane vehicular traffic must be diverted into single lane vehicular traffic,
2. Vehicular traffic must change lanes abruptly,
3. Construction equipment must enter or cross vehicular traffic lanes and walks,
4. Construction equipment may intermittently encroach on vehicular traffic lanes and unprotected walks and crosswalks,
5. Traffic regulation is needed due to rerouting of vehicular traffic around the Work site, and
6. Where construction activities might affect public safety and convenience.

B. Use of Flagmen to assist in the regulation of traffic flow and movement does not relieve Contractor of responsibility to take other means necessary to protect the Work and public.

3.9 INSTALLATION STANDARDS

A. Place temporary pavement for single lane closures, in accordance with TMUTCD.

B. Reinstall temporary and permanent pavement markings as approved by Owner’s Representative. When weather conditions do not allow application according to manufacturer’s requirements, alternate markings may be considered. Submit proposed alternate to Owner’s Representative for approval prior to installation. No additional payment will be made for use of alternate markings.

3.10 MAINTENANCE OF EQUIPMENT AND MATERIAL

A. Submit name, address and telephone number of individual designated to be responsible for maintenance of traffic handling at construction site to Owner's Representative. Individual must be accessible at all times to immediately correct deficiencies in equipment and materials used to handle traffic including missing, damaged, or obscured signs, drums, barricades, or pavement markings.

B. Inspect signs, barricades, drums, lamps and temporary pavement markings daily to verify that they are visible, in good working order, and conform with traffic handling plans as approved by Owner's Representative. Immediately repair, clean, relocate, realign, or replace equipment or materials that are not in compliance.

C. Keep equipment and materials, signs and pavement markings, clean and free of dust, dirt, grime, oil, mud, or debris.

D. Obtain approval of Owner's Representative to reuse damaged or vandalized signs, drums, and barricades.

END OF SECTION 01 55 26

SECTION 01 56 19

TREE PROTECTION AND CARE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Tree and plant protection.

1.2 PROJECT CONDITIONS

A. Preserve and protect existing trees and plants to remain from foliage, branch, trunk, or root damage that could result from construction operations.

B. Prevent following types of damage:

1. Compaction of root zone by foot and/or vehicular traffic or material storage.
2. Trunk damage from equipment operations, material storage, or from nailing or bolting.
3. Trunk and branch damage caused by ropes or guy wires.
4. Root poisoning from spilled solvents, gasoline, paint, and other noxious materials.
5. Branch damage due to improper pruning or trimming.
6. Damage from lack of water due to:
   a. Cutting or altering natural water migration patterns near root zones.
   b. Failure to provide adequate watering.
7. Damage from alteration of soil pH factor caused by depositing lime, concrete, plaster, or other base materials near roots.
8. Cutting of roots larger than 1-½ inches in diameter.

1.3 DAMAGE ASSESSMENT

A. When trees other than those designated for removal are destroyed or badly damaged as a result of construction operations, remove and replace them with same size, species, and variety up to and including eight (8) inches in trunk diameter. Tree larger than eight (8) inches in diameter shall be replaced with an 8-inch diameter tree of the same species and variety and total contract amount will be reduced by an amount determined from the following International Shade Tree Conference formula: $0.7854 \times D^2 \times \$38.00$ where D is diameter in inches of tree or shrub trunk measured twelve (12) inches above grade.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Asphalt Paint: Emulsified asphalt or other adhesive, elastic, antiseptic coating formulated for horticultural use on cut or injured plant tissue, free from kerosene and coal creosote.

B. Burlap: Suitable for use as tree wrapping.

C. Fertilizer: Liquid containing 20-percent nitrogen, 10-percent phosphorus, and 5-percent potash.

D. All necessary tree replacements shall be as approved by the Engineer.

PART 3 E X E C U T I O N

3.1 PROTECTION AND MAINTENANCE OF EXISTING TREES AND SHRUBS

A. Except for trees and shrubs shown on Drawings to be removed, all trees and shrubs within the project area are to remain and be protected from damage.

B. For trees or shrubs to remain, perform the following:

1. Trimming of trees and shrubs to remain shall be done only under supervision of professional tree surgeon or horticulturist.
   a. Tree pruning will be according to International Society of Arborculture specifications.
   b. Trees and shrubs requiring pruning for construction should also be pruned for balance as well as to maintain proper form and branching habit.
   c. Cut limbs at branch collar. No stubs should remain on trees. Branch cuts should not gouge outer layer of tree structure or trunk.
2. Use extreme care to prevent excessive damage to root systems.
   a. Roots in construction areas will be cut smoothly with a trencher before excavation begins. Do not allow ripping of roots with a backhoe or other equipment.
   b. Temporarily cover exposed roots with wet burlap to prevent roots from drying out.
   c. Cover exposed roots with soil as soon as possible.
3. Prevent damage or compaction of root zone (area below dripline) by construction activities.
   a. Do not allow scarring of trunks or limbs by equipment or other means.
   b. Do not store construction materials, vehicles, or excavated material under dripline of trees.
   c. Do not pour liquid materials under dripline.
4. Water and fertilize trees and shrubs that will remain to maintain their health during construction period.
   a. Supplemental watering of landscaping during construction should be done once every seven (7) days in cold months and once every four (4) days in hotter months.
   b. This watering shall consist of saturating soils at least six (6) to eight (8) inches beneath surface.
5. Water areas currently being served by private sprinkler systems while systems are temporarily taken out of service to maintain health of existing landscapes.
6. At option of the Contractor, and with the Engineer’s permission, trees and shrubs to remain may be temporarily transplanted and returned to original positions under supervision of professional horticulturist.

3.2 PROTECTION

A. Protection of Trees or Shrubs in Open Area:

1. Install steel drive-in fence posts in protective circle, approximately 8 feet on center, not closer than four (4) feet to trunk of trees or stems of shrubs.
2. Drive steel drive-in fence posts three (3) feet minimum into ground, leaving five (5) feet minimum above ground.
3. Mount steel hog-wire on fence posts.
4. For trees or shrubs in paved areas, mount concrete-filled steel pipe 2-½ inches in diameter minimum in rubber auto tires filled with concrete (movable posts).

B. Timber Wrap Protection for Trees in Close Proximity of Moving or Mechanical Equipment and Construction Work:

1. Wrap trunk with layer of burlap.
2. Install 2 x 4's or 2 x 5's (5-foot to 6-foot lengths) vertically, spaced three (3) inches to five (5) inches apart around circumference of tree trunk.
3. Tie in place with twelve (12) to nine (9) gauge steel wire.

3.3 MAINTENANCE OF NEWLY PLANTED TREES

A. Show proof of capacity to water during dry periods.

B. The Contractor guarantees that trees planted for this Project shall remain alive and healthy at least until the end of a one-year warranty period and the additional one year period required by the Surface Restoration Bond.

1. Within four (4) weeks of notice from Owner, Contractor shall replace, at his expense, any dead trees or any trees that in the opinion of Owner, have become unhealthy, unsightly, or have lost their natural shape as a result of additional growth, improper pruning or maintenance, or weather conditions.
2. When tree must be replaced, the guarantee period for that tree shall begin on date of replacement of tree, subject to the Owner’s inspection, for no less than one year.
3. Straighten leaning trees and bear entire cost.
4. Dispose of trees rejected at any time by Owner or Engineer at Contractor’s expense.

END OF SECTION 01 56 19

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SECTION 01 57 10

TPDES REQUIREMENTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Documentation to be prepared and signed by Contractor before conducting construction operations, in accordance with the Texas Pollutant Discharge Elimination System (TPDES) Construction General Permit Number TXR 150000 (the Construction General Permit).

B. Implementation, maintenance inspection, and termination of storm water pollution prevention control measures including, but not limited to, erosion and sediment controls, storm water management plans, waste collection and disposal, off-site vehicle tracking, and other appropriate practices shown on the Drawings or specified elsewhere in the Contract.

C. Review of the Storm Water Pollution Prevention Plan (SWP3) implementation in a meeting with the Owner's Representative prior to start of construction.

1.2 DEFINITIONS

A. Commencement of Construction Activities: The exposure of soil resulting from activities such as clearing, grading, and excavating.

B. Large Construction Activity: Project that:

1. Disturbs five acres or more, or
2. Disturbs less than five acres but is part of a larger common plan of development that will disturb five acres or more of land.

C. Small Construction Activity: Project that:

1. Disturbs one or more acres but less than five acres, or
2. Disturbs less than one acre but is part of a larger common plan of development that will ultimately disturb one or more acres but less than five acres.

D. TPDES Operator:

1. The person or persons who have day-to-day operational control of the construction activities which are necessary to ensure compliance with the SWP3 for the site or other Construction General Permit conditions.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.1 SITE SPECIFIC STORM WATER POLLUTION PREVENTION PLAN (SWP3)

A. Prepare a SWP3 following Part III of the Construction General Permit and the applicable local code. If conflicts exist between the Construction General Permit and the local regulations, the more stringent requirements will apply.

B. Update or revise the SWP3 as needed during the construction following Part III, Section E of the Construction General Permit.

C. Submit the SWP3 and any updates or revisions to the Owner's Representative for review and address comments prior to commencing, or continuing, construction activities.

3.2 NOTICE OF INTENT FOR LARGE CONSTRUCTION ACTIVITY

A. Fill out, sign, and date TCEQ Form 20022 Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity under the TPDES Construction General Permit (TXR 150000).

B. Transmit the signed Contractor's copy of TCEQ Form 20022, along with a check for the required fee, made out to Texas Commission on Environmental Quality.

C. Submission of the Notice of Intent form by the Contractor to TCEQ is required a minimum of two days before Commencement of Construction Activities.

3.3 CONSTRUCTION SITE NOTICE FOR SMALL CONSTRUCTION ACTIVITY

A. Fill out, sign, and date the Construction Site Notice, Attachment 2 to TPDES General Permit TXR 150000, "Construction Site Notice."

B. Transmit the signed Construction Site Notice to the Engineer at least seven days prior to Commencement of Construction Activity.

3.4 CERTIFICATION REQUIREMENTS

A. Conduct inspections in accordance with TCEQ requirements. Ensure persons or firms responsible for maintenance and inspection of erosion and sediment control measures read, fill out, sign, and date the Erosion Control Contractor's Certification for Inspection and Maintenance. Use the EPA NPDES Construction Inspection Form

3.5 RETENTION OF RECORDS

A. Keep a copy of this document and the SWP3 in a readily accessible location at the construction site from Commencement of Construction Activity until submission of the Notice of Termination (NOT) for Storm Water Discharges Associated with Construction Activity under TPDES Construction General Permit (TXR 150000). Contractors with day-to-day operational control over SWP3 implementation shall have a copy of the SWP3 available at a central location, on-site, for the use of all operators and those identified as having responsibilities under the SWP3. Upon submission of the NOT, submit all required forms and a copy of the SWP3 with all revisions to the Owner's Representative.

3.6 REQUIRED NOTICES

A. Post the following notices from effective date of the SWP3 until date of final site stabilization as defined in the Construction General Permit:

1. Post the TPDES permit number for Large Construction Activity, or a signed TCEQ Construction Site Notice for Small Construction Activity. A signed copy of the Contractor's NOI must also be posted.

2. Post notices near the main entrance of the construction site in a prominent place for public viewing. Post name and telephone number of Contractor's local contact person, brief project description and location of the SWP3.
   a. If posting near a main entrance is not feasible due to safety concerns, coordinate posting of notice with the Owner's Representative to conform to requirements of the Construction General Permit.
   b. If Project is a linear construction project (e.g.: road, utilities, etc.), post notice in a publicly accessible location near active construction. Move notice as necessary.
3. Post a notice to equipment and vehicles operators, instructing them to stop, check, and clean tires of debris and mud before driving onto traffic lanes. Post at each stabilized construction exit area.
4. Post a notice of waste disposal procedures in a readily visible location on site.

3.7 ON-SITE WASTE MATERIAL STORAGE

A. On-site waste material storage shall be self-contained and shall satisfy appropriate local, state, and federal rules and regulations.

B. Prepare list of waste material to be stored on-site. Update list as necessary to include up-to-date information. Keep a copy of updated list with the SWP3.

C. Prepare description of controls to reduce pollutants generated from on-site storage. Include storage practices necessary to minimize exposure of materials to storm water, and spill prevention and response measures consistent with best management practices. Keep a copy of the description with the SWP3.

3.8 NOTICE OF TERMINATION

A. Submit a NOT to TCEQ and the Engineer within 30 days after:

1. Final stabilization has been achieved on all portions of the site that are the responsibility of the Contractor; or
2. Another operator has assumed control over all areas of the site that have not been stabilized; and
3. All silt fences and other temporary erosion controls have either been removed, scheduled to be removed as defined in the SWP3, or transferred to a new operator if the new operator has sought permit coverage.

END OF SECTION 01 57 10

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SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Dewatering, depressurizing, draining, and maintaining trenches, shaft excavations, structural excavations and foundation beds in stable condition, and controlling ground water conditions for tunnel excavations.

B. Protecting work against surface runoff and rising floodwaters.

C. Trapping suspended sediment in the discharge form the surface and ground water control systems.

PART 2 MEASUREMENT AND PAYMENT

2.1 UNIT PRICES

A. Measurement for control of ground water, if included in Bid Form, will be on either a lump sum basis or a linear foot basis for continuous installations of well points, eductor wells, or deep wells.

B. If not included in Bid Form, include the cost to control ground water in unit price for work requiring such controls.

C. No separate payment will be made for control of surface water. Include cost to control surface water in unit price for work requiring controls.

D. Follow Division 1 for unit price procedures.

E. Stipulated Price (Lump Sum) Contract. If the Contract is a Stipulated Price Contract, include payment for work under this section in the total Stipulated Price.

2.2 REFERENCES

A. ASTM D 698 - Standard Test Methods for Laboratory Compaction of Soils Using Standard Effort (12,400 ft-lbf/ft3 (600kN-m/m3)

B. Federal Regulations, 29 CFR Part 1926, Standards-Excavation, Occupational Safety and Health Administration (OSHA)

C. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

2.3 DEFINITIONS

A. Ground water control system: system used to dewater and depressurize water-bearing soil layers.

1. Dewatering: lowering the water table and intercepting seepage that would otherwise emerge from slopes or bottoms of excavations, or into tunnels and shafts; and

disposing of removed water. Intent of dewatering is to increase stability of tunnel excavations and excavated slopes, prevent dislocation of material from slopes or bottoms of excavations, reduce lateral loads on sheeting and bracing, improve excavating and hauling characteristics of excavated material, prevent failure or heaving of bottom of excavations, and to provide suitable conditions for placement of backfill materials and construction of structures and other installations.

2. Depressurization: includes reduction in piezometric pressure within strata not controlled by dewatering alone, necessary to prevent failure or heaving of excavation bottom or instability of tunnel excavations.

B. Excavation drainage: includes keeping excavations free of surface and seepage water.

C. Surface drainage: includes use of temporary drainage ditches and dikes and installation of temporary culverts and sump pumps with discharge lines necessary to protect Work from any source of surface water.

D. Monitoring facilities for ground water control system: includes piezometers, monitoring wells and flow meters for observing and recording flow rates.

2.4 PERFORMANCE REQUIREMENTS

A. Conduct subsurface investigations to identify groundwater conditions and to provide parameters for design, installation, and operation of groundwater control systems. Submit proposed method and spacing of readings for review prior to obtaining water level readings.

B. Design ground water control system, compatible with requirements of Federal Regulations 29 CFR Part 1926 and Division 2 to produce following results:

1. Effectively reduce hydrostatic pressure affecting:
   a. Excavations
   b. Tunnel excavation, face stability or seepage into tunnels
2. Develop substantially dry and stable subgrade for subsequent construction operations
3. Preclude damage to adjacent properties, buildings, structures, utilities, installed facilities and other work
4. Prevent loss of fines, seepage, boils, quick condition, or softening of foundation strata
5. Maintain stability of sides and bottom of excavations

C. Provide ground water control systems that include single-stage or multiple-stage well point systems, eductor and ejector-type systems, deep wells, or combinations of these equipment types.

D. Provide drainage of seepage water and surface water, as well as water from other sources entering excavation. Excavation drainage may include placement of drainage materials, crushed stone and filter fabric, together with sump pumping.

E. Provide ditches, berms, pumps and other methods necessary to divert and drain surface water from excavation and other work areas.

F. Locate ground water control and drainage systems so as not to interfere with utilities, construction operations, adjacent properties, or adjacent water wells.

G. Assume sole responsibility for ground water control systems and for any loss or damage resulting from partial or complete failure of protective measures and settlement or resultant damage caused by ground water control operations. Modify ground water control systems or operations if they cause or threaten to cause damage to new construction, existing site

improvements, adjacent property, adjacent water wells, or potentially contaminated areas. Repair damage caused by ground water control systems or resulting from failure of system to protect property as required.

H. Install an adequate number of piezometers installed at proper locations and depths, necessary to provide meaningful observations of conditions affecting excavation, adjacent structures and water wells.

I. Install environmental monitoring wells at proper locations and depths necessary to provide adequate observations of hydrostatic conditions and possible contaminant transport from contamination sources into work area or ground water control system.

2.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit Ground Water and Surface Water Control Plan for review by Owner's Representative prior to start of excavation work. Include the following:

1. Results of subsurface investigations and description of extent and characteristics of water bearing layers subject to ground water control
2. Names of equipment Suppliers and installation Subcontractors
3. Description of proposed ground water control systems indicating arrangement, location, depth and capacities of system components, installation details and criteria and operation and maintenance procedures
4. Description of proposed monitoring facilities indicating depths and locations of piezometers and monitoring wells, monitoring installation details and criteria, type of equipment and instrumentation with pertinent data and characteristics
5. Description of proposed filters including types, sizes, capacities and manufacturer's application recommendations
6. Design calculations demonstrating adequacy of proposed systems for intended applications. Define potential area of influence of ground water control operation near contaminated areas.
7. Operating requirements, including piezometric control elevations for dewatering and depressurization
8. Excavation drainage methods including typical drainage layers, sump pump application and other means
9. Surface water control and drainage installations
10. Proposed methods and locations for disposing of removed water

C. Submit following records upon completion of initial installation:

1. Installation and development reports for well points, eductors, and deep wells
2. Installation reports and baseline readings for piezometers and monitoring wells
3. Baseline analytical test data of water from monitoring wells
4. Initial flow rates

D. Submit the following records weekly during control of ground and surface water operations:

1. Records of flow rates and piezometric elevations obtained during monitoring of dewatering and depressurization. Refer to Paragraph 3.02, Requirements for Eductor, Well Points, or Deep Wells.
2. Maintenance records for ground water control installations, piezometers and monitoring wells

2.6 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of agencies having jurisdiction.

B. Comply with Texas Commission on Environmental Quality regulations and Texas Water Well Drillers Association for development, drilling, and abandonment of wells used in dewatering system.

C. Obtain necessary permits from agencies with jurisdiction over use of groundwater and matters affecting well installation, water discharge, and use of existing storm drains and natural water sources. Since review and permitting process may be lengthy, take early action to obtain required approvals.

D. Monitor ground water discharge for contamination while performing pumping in vicinity of potentially contaminated sites.

PART 3 P R O D U C T S

3.1 EQUIPMENT AND MATERIALS

A. Select equipment and materials necessary to achieve desired results for dewatering. Selected equipment and materials are subject to review by Owner's Representative through submittals required in Paragraph 1.06, Submittals.

B. Use experienced contractors, regularly engaged in ground water control system design, installation, and operation, to furnish and install and operate eductors, well points, or deep wells, when needed.

C. Maintain equipment in good repair and operating condition.

D. Keep sufficient standby equipment and materials available to ensure continuous operation, where required.

E. Portable Sediment Tank System: Standard 55-gallon steel or plastic drums, free of hazardous material contamination.

1. Shop or field fabricate tanks in series with main inlet pipe, inter-tank pipes and discharge pipes, using quantities sufficient to collect sediments from discharge water.

PART 4 E X E C U T I O N

4.1 GROUND WATER CONTROL

A. Perform necessary subsurface investigation to identify water bearing layers, piezometric pressures and soil parameters for design and installation of ground water control systems. Perform pump tests, if necessary to determine draw down characteristics. Present results in the Ground Water and Surface Water Control Plan submittal.

B. Provide labor, material, equipment, techniques and methods to lower, control and handle ground water in manner compatible with construction methods and site conditions. Monitor effectiveness of installed system and its effect on adjacent property.

C. Install, operate, and maintain ground water control systems in accordance with the Ground Water and Surface Water Control Plan. Notify Owner's Representative in writing of changes made to accommodate field conditions and changes to Work. Provide revised drawings and calculations with notification.

D. Provide continuous system operation, including nights, weekends, and holidays. Arrange appropriate backup if electrical power is primary energy source for dewatering system.

E. Monitor operations to verify systems lower ground water piezometric levels at rate required to maintain dry excavation resulting in stable subgrade for subsequent construction operations.

F. Depressurize zones where hydrostatic pressures in confined water bearing layers exist below excavations to eliminate risk of uplift or other instability of excavation or installed works. Define allowable piezometric elevations in the Ground Water and Surface Water Control Plan.

G. Removal of ground water control installations.

1. Remove pumping system components and piping when ground water control is no longer required.
2. Remove piezometers, including piezometers installed during design phase investigations and left for Contractor's use, upon completion of testing, as required in accordance with Part 3 of applicable specification.
3. Remove monitoring wells when directed by Owner's Representative.
4. Grout abandoned well and piezometer holes. Fill piping that is not removed with cement-bentonite grout or cement-sand grout.

H. During backfilling, maintain water level a minimum of 5 feet below prevailing level of backfill. Do not allow the water level to cause uplift pressures in excess of 80 percent of downward pressure produced by weight of structure or backfill in place. Do not allow water levels to rise into cement-stabilized sand until at least 48 hour after placement.

I. Provide uniform pipe diameter for each pipe drain run constructed for dewatering. Remove pipe drains when no longer required. If pipe removal is impractical, grout connections at 50-foot intervals and fill pipe with cement-bentonite grout or cement-sand grout after removal from service.

J. The extent of ground water control for structures with permanent perforated underground drainage systems may be reduced, for units designed to withstand hydrostatic uplift pressure. Provide a means to drain affected portions of underground systems, including standby equipment. Maintain drainage systems during construction operations.

K. Remove systems upon completion of construction or when dewatering and control of surface or ground water is no longer required.

L. Compact backfill to not less than 95 percent of maximum dry density in accordance with ASTM D 698.

M. Foundation Slab: Maintain saturation line at least 3 feet below lowest elevations where concrete is to be placed. Drain foundations in areas where concrete is to be placed before placing reinforcing steel. Keep free from water for 3 days after concrete is placed.

4.2 REQUIREMENTS FOR EDUCTOR, WELL POINTS, OR DEEP WELLS

A. For aboveground piping in ground water control system, include a 12-inch minimum length of clear, transparent piping between each eductor well or well point and discharge header to allow visual monitoring of discharge from each installation.

B. Install sufficient piezometers or monitoring wells to show that trench or shaft excavations in water bearing materials are pre-drained prior to excavation. Provide separate piezometers for monitoring of dewatering and for monitoring of depressurization. Install piezometers and monitoring wells for tunneling as appropriate for selected method of work.

C. Install piezometers or monitoring wells at least one week in advance of the start of associated excavation.

D. Dewatering may be omitted for portions of under drains or other excavations, where auger borings and piezometers or monitoring wells show that soil is pre-drained by existing systems and that ground water control plan criteria are satisfied.

E. Replace installations that produce noticeable amounts of sediments after development.

F. Provide additional ground water control installations, or change method of control if, ground water control plan does not provide satisfactory results based on performance criteria defined by plan and by specifications. Submit revised plan according to Paragraph 1.06B.

4.3 SEDIMENT TRAPS

A. Install sediment tank as shown on approved plan.

B. Inspect daily and clean out tank when one-third of sediment tank is filled with sediment.

4.4 SEDIMENT SUMP PIT

A. Install sediment sump pits as shown on approved plan.

B. Construct standpipe by perforating 12 inch to 24-inch diameter corrugated metal or PVC pipe.

C. Extend standpipe 12 inches to 18 inches above lip of pit.

D. Convey discharge of water pumped from standpipe to sediment trapping device.

E. Fill sites of sump pits, compact to density of surrounding soil and stabilize surface when construction is complete.

4.5 EXCAVATION DRAINAGE

A. Use excavation drainage methods if well-drained conditions can be achieved. Excavation drainage may consist of layers of crushed stone and filter fabric, and sump pumping, in combination with sufficient ground water control wells to maintain stable excavation and backfill conditions.

4.6 MAINTENANCE AND OBSERVATION

A. Conduct daily maintenance and observation of piezometers or monitoring wells while ground water control installations or excavation drainage is operating at the site, or water is seeping into tunnels, and maintain systems in good operating condition.

B. Replace damaged and destroyed piezometers or monitoring wells with new piezometers or wells as necessary to meet observation schedules.

C. Cut off piezometers or monitoring wells in excavation areas where piping is exposed, only as necessary to perform observation as excavation proceeds. Continue to maintain and make specified observations.

D. Remove and grout piezometers inside or outside of excavation area when ground water control operations are complete. Remove and grout monitoring wells when directed by Owner's Representative.

4.7 MONITORING AND RECORDING

A. Monitor and record average flow rate of operation for each deep well, or for each wellpoint or eductor header used in dewatering system. Also, monitor and record water level and ground water recovery. Record observations daily until steady conditions are achieved and twice weekly thereafter.

B. Observe and record elevation of water level daily as long as ground water control system is in operation, and weekly thereafter until Work is completed or piezometers or wells are removed, except when Owner's Representative determines more frequent monitoring and recording are required. Comply with Owner's Representative's direction for increased monitoring and recording and take measures necessary to ensure effective dewatering for intended purpose.

4.8 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through use of dikes, ditches, curb walls, pipes, sumps or other approved means. Requirement includes temporary works required to protect adjoining properties from surface drainage caused by construction operations.

B. Divert surface water and seepage water into sumps and pump it into drainage channels or storm drains, when approved by agencies having jurisdiction. Provide settling basins when required by agencies.

END OF SECTION 01 57 19

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SECTION 01 57 23

TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Implementation of Storm Water Pollution Prevention Plans (SWP3) described in Division 1.

B. Installation and maintenance of storm-water pollution prevention structures: diversion dikes, interceptor dikes, diversion swales, interceptor swales, down spout extenders, pipe slope drains, paved flumes and level spreaders. Structures are used during construction and prior to final development of the site.

C. Filter Fabric Fences:

1. Type 1: Temporary filter fabric fences for erosion and sediment control in non-channelized flow areas.
2. Type 2: Temporary reinforced filter fabric fences for erosion and sediment control in channelized flow areas.

D. Straw Bale Fence.

1.2 MEASUREMENT AND PAYMENT

A. UNIT PRICES

1. Payment for filter fabric fence is on a linear foot basis measured between limits of beginning and ending of stakes.
2. Payment for reinforced filter fabric fence is on a linear foot basis measured between limits of beginning and ending of stakes.
3. Payment for drop inlet baskets is on a unit price basis for each drop inlet basket.
4. Payment for storm inlet sediment traps is on a unit price basis for each storm inlet sediment trap.
5. Payment for storm-water-pollution-prevention structures is on a lump sum basis for the project. Earthen structures with outlet and piping includes diversion dikes, interceptor dikes, diversion swales, interceptor swales, and excavated earth-outlet sediment trap, embankment earth-outlet sediment trap, down spout extenders, pipe slope drains, paved flumes, stone outlet sediment trap, and level spreaders.
6. Payment for straw bale barrier, if included in Bid Form, is on a linear foot of accepted bale barriers, if not include in cost of storm-water-pollution-prevention structures.
7. Payment for brush berm, if included in Bid Form, is on a linear foot of accepted brush berm, if not include in cost of storm water-pollution-prevention structures.
8. Payment for sandbag barrier, if included in Bid Form, is on a linear foot basis measured between limits of beginning and ending of sandbags, if not include in cost of storm-water-pollution prevention structures.
9. Payment for sediment basin with pipe outlet or stone outlet, if included in Bid Form, is on a square yard basis, if not include in cost of storm-water-pollution-prevention structures.
10. Payment for inlet protection barriers, if included in Bid Form, is on a linear foot basis measured along the outside face of inlet protection barrier, if not include in cost of storm-water-pollution prevention structures.
11. Refer to Division 1 for unit price procedures.

B. Stipulated Price (Lump Sum) Contract. If Contract is Stipulated Price Contract, payment for Work in this Section is included in total Stipulated Price.

1.3 REFERENCE STANDARDS

A. ASTM

1. A 36 - Standard Specification for Carbon Structural Steel.
2. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 ft-lbf/ft3 (600 kN-m/m3)].
3. D3786 - Standard Test Method for Hydraulic Bursting Strength for Knitted Goods and Nonwoven Fabrics.
4. D 4355 - Standard Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
5. D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
6. D 4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
7. D 4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
8. D 6382 - Standard Practice for Dynamic Mechanical Analysis and Thermogravimetry of Roofing and Waterproofing Membrane Material.

B. Storm Water Management Handbook for Construction Activities prepared by City of Houston, Harris County and Harris County Flood Control District.

1.4 SYSTEM DESCRIPTIONS

A. Filter Fabric Fence Type 1 and Type 2: Install to allow surface or channel runoff percolation through fabric in sheet-flow manner and to retain and accumulate sediment. Maintain Filter Fabric Fences to remain in proper position and configuration at all times.

B. Straw Bale Fence: Install to allow surface runoff percolation through straw in sheet-flow manner and to retain and accumulate sediment. Maintain Straw Bale Fence to remain in proper position and configuration at all times.

C. Interceptor Dikes and Swales: Construct to direct surface or channel runoff around the project area or runoff from project area into sediment traps.

D. Drop Inlet Baskets: Install to allow runoff percolation through the basket and to retain and accumulate sediment. Clean accumulation of sediment to prevent clogging and backups.

E. Sediment traps: Construct to pool surface runoff from construction area to allow sediment to settle onto the bottom of trap.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit manufacturer’s catalog sheets and other product data on geotextile or filter fabrics, outlet pipe, perforated riser and connectors.

D. Submit proposed methods, equipment, materials, and sequence of operations for storm-water pollution prevention structures.

E. Submit shop drawings for Drop Inlet Baskets.

PART 2 P R O D U C T S

2.1 CONCRETE

A. Concrete: Class B in accordance with Division 32 or as shown on the Drawings.

2.2 AGREGATE MATERIALS

A. Use poorly graded cobbles with diameter greater than 3 inches and less than 5 inches.

B. Provide gravel lining in accordance with Division 31 or as shown on the drawings.

C. Provide clean cobbles and gravel consisting of crushed concrete or stone. Use clean, hard crushed concrete or stone free from adherent coatings, salt, alkali, dirt, clay, loam, shale, soft or flaky materials, or organic matter.

D. Sediment Pump Pit Aggregate: Use nominal 2-inch diameter river gravel.

2.3 PIPE

A. Polyethylene culvert pipe or PVC sewer pipe in accordance with Division 33 or as shown on the Drawings.

B. Inlet Pipes: Galvanized steel pipe in accordance with Division 33 or as shown on the Drawings.

C. Standpipe for Sediment Pump Pits: Galvanized round culvert pipe or round PVC pipe, minimum of 12-inch and a maximum of 24-inch diameter, perforate at 6 to 12 inch centers around circumference.

2.4 GEOTEXTILE FILTER FABRIC

A. Woven or nonwoven geotextile filter fabric made of either polypropylene, polyethylene, ethylene, or polyamide material, in continuous rolls of longest practical length.

B. Grab Strength: 100 psi in any principal direction (ASTM D-4632), Mullen burst strength >200 psi (ASTM D-3786), and equivalent opening size between 50 and 140.

C. Furnish ultraviolet inhibitors and stabilizers for minimum 6 months of expected usable construction life at temperature range of 0 degrees F to 120 degrees F.

D. Mirafi, Inc., Synthetic Industries, or equivalent.

2.5 FENCING

A. Wire Fencing: Woven galvanized steel wire, 14 gauge by 6-inch square mesh spacing, minimum 24 inch roll or sheet width of longest practical length.

B. Fence Stakes: Nominal 2 x 2 inch moisture-resistant treated wood or steel posts (min. of 1.25 lbs. per linear foot and Brinell Hardness greater than 140) with safety caps on top; length as required for minimum 8 inch bury and full height of filter fabric.

2.6 SANDBAGS

A. Provide woven material made of polypropylene, polyethylene, or polyamide material.

1. Minimum unit weight of four ounces per square yard.
2. Minimum grab strength of 100 psi in any principal direction (ASTM D4632).
3. Mullen burst strength exceeding 300 psi (ASTM D3786).
4. Ultraviolet stability exceeding 70 percent.
5. Size: Length: 18 to 24 inches. Width: 12 to 18 inches. Thickness: 6 to 8 inches. Weight: 50 to 125 pounds.

2.7 DROP INLET BASKET

A. Provide steel frame members in accordance with ASTM A36.

B. Construct top frame of basket with two short sides of 2 inch by 2 inch and single long side of 1 inch by 1 inch, 1/8 inch angle iron. Construct basket hangers of 2 inch by 1/4 inch iron bars. Construct bottom frame of 1 inch by 1/4 inch iron bar or 1/4 inch plate with center 3 inches removed. Use minimum 1/4 inch diameter iron rods or equivalent for sides of inlet basket. Weld minimum of 14 rods in place between top frame/basket hanger and bottom frame. Exact dimensions for top frame and insert basket will be determined based on dimensions of type of inlet being protected.

2.8 STRAW BALE

A. Straw: Standard-baled agricultural hay bound by wire, nylon, or polypropylene rope. Do not use jute or cotton binding.

B. Straw Bale Stakes (applicable where bales are on soil): No. 3 (3/8 diameter) reinforcing bars, deformed or smooth at Contractor's option, length as required for minimum 18 inch bury and full height bales.

PART 3 E X E C U T I O N

3.1 PREPARATION, INSTALLATION AND MAINTENANCE

A. Provide erosion and sediment control structures at locations shown on the Drawings.

B. Do not clear, grub or rough cut until erosion and sediment control systems are in place unless approved by Project Manger to allow installation of erosion and sediment control systems, soil testing and surveying.

C. Maintain existing erosion and sediment control systems located within project site until acceptance of Project or until directed by Project Manger to remove and discard existing system.

D. Regularly inspect and repair or replace damaged components of erosion and sediment control structures. Unless otherwise directed, maintain erosion and sediment control structure until project area stabilization is accepted. . Redress and replace granular fill at outlets as needed to replenish depleted granular fill. Remove erosion and sediment control

structures promptly when directed by Project Manger. Dispose of materials in accordance with Division 1.

E. Remove and dispose sediment deposits at the designated spoil site for the Project. If a project spoil site is not designated on Drawings, dispose of sediment off site at approved location in accordance with Division 1.

F. Unless otherwise shown on the Drawings, compact embankments, excavations, and trenches in accordance with Division 31.

G. Prohibit equipment and vehicles from maneuvering on areas outside of dedicated right of way and easements for construction. Immediately repair damage caused by construction traffic to erosion and sediment control structures.

H. Protect existing trees and plants in accordance with Division 1.

3.2 SEDIMENT TRAPS

A. Install sediment traps so that surface runoff shall percolate through system in sheet flow fashion and allow retention and accumulation of sediment.

B. Inspect sediment traps after each rainfall, daily during periods of prolonged rainfall, and at a minimum once each week. Repair or replace damaged sections immediately.

C. Use fill material for embankment in accordance with Division 31.

D. Excavation length and height shall be as specified on Drawings. Use side slopes of 2:1 or flatter.

E. Stone outlet sediment traps:

1. Maintain minimum of 6 inches between top of core material and top of stone outlet, minimum of 4 inches between bottom of core material and existing ground and minimum of 1 foot between top of stone outlet and top of embankment.
2. Embed cobbles minimum of 4 inches into existing ground for stone outlet. Core shall be minimum of 1 foot in height and in width and wrapped in triple layer of geotextile filter fabric.

F. Sediment Basin with Pipe Outlet Construction Methods: Install outlet pipe and riser as shown on the Drawings.

G. Remove sediment deposits when design basin volume is reduced by one-third or sediment level is one foot below principal spillway crest, whichever is less.

3.3 FILTER FABRIC FENCE CONSTRUCTION METHODS

A. Fence Type 1

1. Install stakes 3 feet on center maximum and firmly embed minimum 8 inches in soil. If filter fabric is factory pre-assembled with support netting, then maximum support spacing is 8 feet. Install wood stakes at a slight angle toward the source of anticipated runoff.
2. Trench in the toe of the fence lines so the downward face of the trenches is flat and perpendicular to direction of flow. V-trench configuration as shown on Drawings may also be used.

3. Lay fabric along edges of trenches in longest practical continuous runs to minimize joints. Make joints only at a support post. Splice with minimum 6-inch overlap and seal securely.
4. Staple filter fabric to stakes at maximum 3 inches on center. Extend fabric minimum 18 inches and maximum 36 inches above natural ground.
5. Backfill and compact trench.

B. Fence Type 2

1. Layout fence same as for Type 1.
2. Install stakes at 6 feet on center maximum and at each joint in wire fence, firmly embedded 1-foot minimum, and inclined it as for Type 1.
3. Tie wire fence to stakes with wire at 6 inches on center maximum. Overlap joints minimum one bay of mesh.
4. Install trench same as for Type 1.
5. Fasten filter fabric wire fence with tie wires at 3 inches on center maximum.
6. Layout fabric same as for Type 1. Fasten to wire fence with wire ties at 3 inches on center maximum and, if applicable, to stakes above top of wire fence it as for Type 1.
7. Backfill and compact trench.

C. Attach filter fabric to wooden fence stakes spaced a maximum of 6 feet apart or steel fence stakes spaced a maximum of 8 feet apart and embedded a minimum of 12 inches. Install stakes at a slight angle toward source of anticipated runoff.

D. Trench in toe of filter fabric fence with spade or mechanical trencher so that downward face of trench is flat and perpendicular to direction of flow. A V-trench configuration may also be used. Lay filter fabric along edges of trench. Backfill and compact trench upon completion of Construction.

E. Filter fabric fence shall have a minimum height of 18 inches and a maximum height of 36 inches above natural ground.

F. Cut length of fence to minimize use of joints. When joints are necessary, splice fabric together only at support post with minimum 6 inch overlap and seal securely.

G. Triangular Filter Fabric Fence Construction Methods

1. Attach filter fabric to wire fencing, 18 inches on each side. Provide a fabric cover and skirt with continuous wrapping of fabric. Skirt should form continuous extension of fabric on upstream side of fence.
2. Secure triangular fabric filter fence in place using one of the following methods:
   a. Toe-in skirt 6 inches with mechanically compacted material;
   b. Weight down skirt with continuous layer of 3-inch to 5-inch graded rock; or
   c. Trench-in entire structure 4 inches.
3. Anchor triangular fabric filter fence structure and skirt securely in place using 6-inch wire staples on 2-foot centers on both edges and on skirt, or staked using 18-inch by 3/8-inch diameter re-bar with tee ends.
4. Lap fabric filter material by 6 inches to cover segment joints. Fasten joints with galvanized shoat rings.

H. Reinforced Filter Fabric Barrier Construction Methods

1. Attach woven wire fence to fence stakes.
2. Securely fasten filter fabric material to wire fence with tie wires.

3. When used in swales, ditches or diversions, elevation of barrier at top of filter fabric at flow line location in channel shall be lower than bottom elevation of filter fabric at ends of barrier or top of bank, whichever is less, in order to keep storm water discharge in channel from overtopping bank.
4. Remove sediment deposits when silt reaches depth one-third height of barrier or 6 inches, whichever is less.

3.4 DIKE AND SWALE

A. Unless otherwise indicated, maintain minimum dike height of 18 inches, measured from cleared ground at up slope toe to top of dike. Maintain side slopes of 2:1 or flatter.

B. Dike and Swale Stabilization: When shown on the Drawings, place gravel lining 3 inches thick and compacted into the soil or 6 inches thick if truck crossing is expected. Extend gravel lining across bottom and up both sides of swale minimum height of 8 inches vertically, above bottom. Gravel lining on dike side shall extend up the up slope side of dike a minimum height of 8 inches, measured vertically from interface of existing or graded ground and up slope toe of dike, as shown on Drawings.

C. Divert flow from dikes and swales to sediment basins, stabilized outlets, or sediment trapping devices of types and at locations shown on Drawings. Grade dikes and swales as shown on Drawings, or, if not specified, provide positive drainage with maximum grade of 1 percent to outlet or basin.

D. Clear in accordance with Division 31.

E. Carry out excavation for swale construction so that erosion and water pollution is minimal. Minimum depth shall be 1 foot and bottom width shall be 4 feet, with level swale bottom. Excavation slopes shall be 2:1 or flatter. Clear, grub and strip excavation area of vegetation and root material.

3.5 DOWN SPOUT EXTENDER

A. Down spout extender shall have slope of approximately 1 percent. Use pipe diameter of 4 inches or as shown on the Drawings. Place pipe in accordance with Division 33.

3.6 PIPE SLOPE DRAIN

A. Compact soil around and under drain entrance section to top of embankment in lifts appropriately sized for method of compaction utilized.

B. Inlet pipe shall have slope of 1 percent or greater. Use pipe diameter as shown on the Drawings.

C. Top of embankment over inlet pipe and embankments directing water to pipe shall be at least 1 foot higher at all points than top of inlet pipe.

D. Pipe shall be secured with hold-down grommets spaced 10 feet on centers.

E. Place riprap apron with a depth equal to pipe diameter with 2:1 side slopes.

3.7 PAVED FLUME

A. Compact soil around and under the entrance section to top of the embankment in lifts appropriately sized for method of compaction utilized.

B. Construct subgrade to required elevations. Remove and replace soft sections and unsuitable material. Compact subgrade thoroughly and shape to a smooth, uniform surface.

C. Construct permanent paved flumes in accordance with Drawings.

D. Remove sediment from riprap apron when sediment has accumulated to depth of one foot.

3.8 LEVEL SPREADER

A. Construct level spreader on undisturbed soil and not on fill. Ensure that spreader lip is level for uniform spreading of storm runoff.

B. Maintain at required depth, grade, and cross section as specified on Drawings. Remove sediment deposits as well as projections or other irregularities which will impede normal flow.

3.9 INLET PROTECTION BARRIER

A. Place sandbags and filter fabric fences at locations shown on the SWP3.

3.10 DROP INLET BASKET CONSTRUCTION METHODS.

A. Fit inlet insert basket into inlet without gaps around insert at locations shown on the SWP3.

B. Support for inlet insert basket shall consist of fabricated metal as shown on Drawings.

C. Push down and form filter fabric to shape of basket. Use sheet of fabric large enough to be supported by basket frame when holding sediment and extend at least 6 inches past frame. Place inlet grates over basket/frame to serve as fabric anchor.

D. Remove sediment deposit after each storm event and whenever accumulation exceeds 1-inch depth during weekly inspections.

3.11 STRAW BALE FENCE CONSTRUCTION METHODS

A. Place bales in row with ends tightly abutting adjacent bales. Place bales with bindings parallel to ground surface.

B. Embed bale in soil a minimum of 4 inches.

C. Securely anchor bales in place with Straw Bale Stakes driven through bales a minimum of 18-inches into ground. Angle first stake in each bale toward previously laid bale to force bales together.

D. Fill gaps between bales with straw to prevent water from channeling between bales. Wedge carefully in order not to separate bales.

E. Replace with new straw bale fence every two months or as required by Owner’s Representative.

3.12 BRUSH BERM CONSTRUCTION METHODS

A. Construct brush berm along contour lines by hand placing method. Do not use machine placement of brush berm.

B. Use woody brush and branches having diameter less than 2-inches with 6-inches overlap. Avoid incorporation of annual weeds and soil into brush berm.

C. Use minimum height of 18-inches measured from top of existing ground at upslope toe to top of berm. Top width shall be 24 inches minimum and side slopes shall be 2:1 or flatter.

D. Embed brush berm into soil a minimum of 4-inches and anchor using wire, nylon or polypropylene rope across berm with a minimum tension of 50 pounds. Tie rope securely to 18-inch x 3/8-inch diameter rebar stakes driven into ground on 4-foot centers on both sides of berm.

3.13 STREET AND SIDEWALK CLEANING

A. Keep areas clean of construction debris and mud carried by construction vehicles and equipment. If necessary, install stabilized construction exits at construction, staging, storage, and disposal areas, following Division 1.

B. In lieu of or in addition to stabilized construction exits, shovel or sweep pavements as required to keep areas clean. Do not water hose or sweep debris and mud off street into adjacent areas, except, hose sidewalks during off-peak hours, after sweeping.

3.14 WASTE COLLECTION AREAS

A. Prevent water runoff from passing through waste collection areas, and prevent water runoff from waste collection areas migrating outside collection areas.

3.15 EQUIPMENT MAINTENANCE AND REPAIR

A. Confine maintenance and repair of construction machinery and equipment to areas specifically designated for that purpose, so fuels, lubricants, solvents, and other potential pollutants are not washed directly into receiving streams or storm water conveyance systems. Provide these areas with adequate waste disposal receptacles for liquid and solid waste. Clean and inspect maintenance areas daily.

B. Where designated equipment maintenance areas are not feasible, take precautions during each individual repair or maintenance operation to prevent potential pollutants from washing into streams or conveyance systems. Provide temporary waste disposal receptacles.

3.16 VEHICLE/ EQUIPMENT WASHING AREAS

A. Install wash area (stabilized with coarse aggregate) adjacent to stabilized construction exit(s), as required to prevent mud and dirt run-off. Release wash water into drainage swales or inlets protected by erosion and sediment controls. Build wash areas following Division 1. Install gravel or rock base beneath wash areas.

B. Wash vehicles only at designated wash areas. Do not wash vehicles such as concrete delivery trucks or dump trucks and other construction equipment at locations where runoff flows directly into watercourses or storm water conveyance systems.

C. Locate wash areas to spread out and evaporate or infiltrate wash water directly into ground, or collect runoff in temporary holding or seepage basins.

3.17 WATER RUNOFF AND EROSION CONTROL

A. Control surface water, runoff, subsurface water, and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.

B. Control fill, grading and ditching to direct water away from excavations, pits, tunnels, and other construction areas, and to direct drainage to proper runoff courses to prevent erosion, sedimentation or damage.

C. Provide, operate, and maintain equipment and facilities of adequate size to control surface water.

D. Dispose of drainage water to prevent flooding, erosion, or other damage to the site or adjoining areas. Follow environmental requirements.

E. Retain existing drainage patterns external to the site by constructing temporary earth berms, sedimentation basins, retaining areas, and temporary ground cover as required to control conditions.

F. Plan and execute construction and earth work to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.

1. Hold area of bare soil exposed at one time to a minimum.
2. Provide temporary controls such as berms, dikes, and drains.

G. Construct fill and waste areas by selective placement to eliminate surface silts or clays which will erode.

H. Inspect earthwork periodically to detect start of erosion. Immediately apply corrective measures as required to control erosion.

I. Dispose of sediments offsite, not in or adjacent to streams or floodplains, nor allow sediments to flush into streams or drainage ways. Assume responsibility for offsite disposal location.

J. Unless otherwise indicated, compact embankments, excavations, and trenches by mechanically blading, tamping, and rolling soil in maximum of 8-inch layers. Provide compaction density at minimum 90 percent Standard Proctor ASTM D-698-78 density. Make at least one test per 500 cubic yards of embankment.

K. Do not maneuver vehicles on areas outside of dedicated rights-of-way and easements for construction. Immediately repair damage to erosion and sedimentation control systems caused by construction traffic.

L. Do not damage existing trees intended to remain.

3.18 REMOVAL OF CONTROLS

A. Remove erosion and sediment controls when the site is finally stabilized or as directed by Owner’s Representative.

B. Dispose of sediments and waste products following Division 1.

END OF SECTION 01 57 23

SECTION 01 62 00

PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for product options and substitutions.

B. Related Requirements:
1. Section 01 31 00 - Project Management and Coordination: Coordination of construction.
2. Section 01 33 23 - Shop Drawings, Product Data, and Samples: Product data submittals.
3. Section 01 42 00 - References: Applicability of specified reference standards.
4. Section 01 78 23 - Operation and Maintenance Data.
5. Section 01 78 39 - Project Record Documents.

1.2 PRODUCT LIST

A. Within 30 days after date of contract, submit to the Architect a list of products and materials which are proposed for substitution per SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

1.3 CONTRACTOR'S OPTIONS

A. For products specified only by reference standards, select any product meeting standards, by any manufacturer.

B. For products specified by naming several products or manufacturers, followed by the words "NO SUBSTITUTIONS", select one of the products/manufacturers named.

C. For products specified by naming only one product and manufacturer, there is no option unless a substitution is approved as specified below.

D. For products specified by naming only one product and manufacturer, followed by the words "NO SUBSTITUTIONS", there is no option.

1.4 SUBSTITUTIONS

A. Requests for substitution to material, products, or equipment instead of those specified will be considered if received at least 10 days prior to the bid date. Substitution request received within 10 days of the bid date will be returned without review. Refer to Substitution Request (During the Bidding Phase) form attached to this section.

B. Within 30 days after Notice to Proceed, Architect will consider additional formal requests from the Contractor for substitutions of products in place of those specified. Refer to Substitution Request (After the Bidding Phase) form attached to this section.

C. Submit a separate request for each substitution on a copy of the "SUBSTITUTION REQUEST" form, attached to this section. Include in request:
1. Complete data substantiating compliance of proposed substitution with contract documents.
2. For products:
   a. Product identification, including manufacturer's name and address.
   b. Manufacturer's literature, including product description, performance and test data and reference standards.
   c. Samples, if applicable.
   d. Name and address of similar projects on which product was used and date of installation.
3. For construction methods:
   a. Detailed written descriptions of proposed method.
   b. Complete drawings illustrating methods or revisions.
4. Itemized Comparison of qualities of proposed substitution with product or method specified.
5. Changes required in other elements of work because of substitution.
6. Effect on construction schedule.

D. Request for substitution constitutes a representation that General Contractor or Construction Manager:
   1. Has personally investigated proposed product or method and determined that it is equal to or superior in all respects to that specified.
   2. Will provide same warranties for substitution as for product or method specified.
   3. Will coordinate installation of accepted substitution into the work, making such changes as may be required for the work to be complete in all respects.
   4. Waives all claims for additional cost, under his responsibility and related to substitution, which subsequently become apparent.

E. Substitutions will not be considered if:
   1. They are indicated or implied on shop drawings or product data submittals without formal request submitted in accordance with this section.
   2. Acceptance will require substantial revision of contract documents.

F. If substitution is not approved or accepted, Contractor shall furnish specified product or method at no additional cost to the Owner.

G. Acceptance of a proposed substitution prior to the bid date will be in the form of an addendum.

1.5 SUBMITTAL PROCEDURES

A. Submit request for substitution.

B. Architect will review Contractor's requests for substitutions with reasonable promptness.

C. For accepted products, submit shop drawings, product data, and samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SUBSTITUTION REQUEST
(During the Bidding Phase)
(Submittal must be received 10 days prior to bid/proposal date)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, custom color/pre-selected color availability, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E/ design, detailing, and construction costs caused by the substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

A/E REVIEW AND ACTION

☐ Substitution approved - Submit bid/proposal based on accepted substitution.

☐ Substitution approved as noted - Submit bid/proposal based on accepted substitution - as noted.

☐ Substitution rejected - Submit bid/proposal for specified materials.

☐ Substitution Request received too late - Submit bid/proposal for specified materials.

Signed by: _____ Date: _____

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐_____

SUBSTITUTION REQUEST
(After the Bidding Phase)
(Submittal must be received not later than 30 days after Notice to Proceed)

Project: _____ Substitution Request Number: _____

_____ From: _____

To: _____ Date: _____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____ Description: _____

Section No.: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____

Manufacturer: _____ Address: _____ Phone: _____

Trade Name: _____ Model No.: _____

History: ☐ New product ☐ 2-5 years old ☐ 5-10 years old ☐ More than 10 years old

Differences between proposed substitution and specified product: _____

_____

_____

For finish materials and pre-finished equipment, list the colors available for the specified item and the colors available for the proposed substitution.

☐ Point-by-point comparative data attached - REQUIRED BY A/E

Reason for not providing specified item: _____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: ☐ No ☐ Yes; explain _____

_____

Savings to Owner for accepting substitution: _____ ($ _____).

Proposed substitution changes Contract Time: ☐ No ☐ Yes [Add] [Deduct] _____days.

Supporting Data Attached: ☐ Drawings ☐ Product Data ☐ Samples ☐ Tests ☐ Reports ☐ _____

SUBSTITUTION REQUEST - Continued

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachments: _____

_____

_____

_____

A/E REVIEW AND ACTION

☐ Substitution approved - Make submittals in accordance with Section 01 33 23.

☐ Substitution approved as noted - Make submittals in accordance with Section 01 33 23.

☐ Substitution rejected - Use specified materials.

☐ Substitution Request received too late - Use specified materials.

Signed by: _____ Date _____

Additional Comments: ☐ Contractor ☐ Subcontractor ☐ Supplier ☐ Manufacturer ☐ A/E ☐_____

_____

_____

_____

_____

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SECTION 01 65 00

PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included:
   1. Packaging, Transportation.
   2. Delivery and Receiving.
   3. Product Handling.

B. Related Requirements:
   1. Section 01 32 16 - Construction Progress Schedules.
   2. Section 01 33 23 - Shop Drawings, Product Data and Samples: Manufacturers' Instructions.
   3. Section 01 66 00 - Product Storage and Handling Requirements.
   4. Individual Sections: Specific requirements for packaging, shipping and handling.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PACKAGING, TRANSPORTATION

A. Require supplier to package products in boxes or crates for protection during shipment, handling and storage. Protect sensitive products against exposure to elements and moisture.

B. Protect sensitive equipment and finishes against impact, abrasion and other damage.

3.2 DELIVERY AND RECEIVING

A. Arrange deliveries of products in accordance with construction progress schedules. Allow time for inspection prior to installation.

B. Coordinate deliveries to avoid conflict with work and conditions at site; limitations on storage space; availability of personnel and handling equipment; and Owner's use of premises.

C. Deliver products in undamaged, dry condition, in original unopened containers or packaging with identifying labels intact and legible.

D. Clearly mark partial deliveries of component parts of equipment to identify equipment and contents to permit easy accumulation of parts and to facilitate assembly.

E. Immediately on delivery, inspect shipment to assure
   1. Product complies with requirements of contract documents and reviewed submittals.
   2. Quantities are correct.
   3. Accessories, and installation hardware are correct.
   4. Containers and packages are intact and labels legible.
   5. Products are protected and undamaged.

3.3 PRODUCT HANDLING

A. Provide equipment and personnel to handle products by methods to prevent soiling and damage.

B. Provide additional protection during handling to prevent marring and otherwise damaging products, packaging and surrounding surfaces.

C. Handle product by methods to avoid bending or over-stressing. Lift large and heavy components only at designated lift points.

END OF SECTION

SECTION 01 66 00

PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Included:
   1. Storage, General.
   2. Enclosed Storage.
   3. Exterior Storage.
   4. Maintenance of Storage.

B. Related Requirements:
   1. Section 01 11 00 - Summary of Work.
   2. Section 01 50 00 - Construction Facilities and Temporary Controls: Storage facilities. Protection of installed work.
   3. Section 01 65 00 - Product Delivery Requirements.
   4. Section 01 78 39 - Project Record Documents.

PART 2 - PRODUCTS - Not used.

PART 3 - EXECUTION

3.1 STORAGE, GENERAL

A. Store products, immediately on delivery, in accordance with manufacturer's instructions, with seals and labels intact. Protect until installed.

B. Arrange storage in a manner to provide access for maintenance of stored items and for inspection.

3.2 ENCLOSED STORAGE

A. Store products, subject to damage by the elements, in substantial weathertight enclosures.

B. Maintain temperature and humidity within ranges stated in manufacturer's instructions.

C. Provide humidity control and ventilation for sensitive products as required by manufacturer's instructions.

D. Store unpacked and loose products on shelves, in bins, or in neat groups of like items.

3.3 EXTERIOR STORAGE

A. Provide substantial platforms, blocking, or skids, to support fabricated products above ground; slope to provide drainage. Protect products from soiling and staining.

B. For products subject to discoloration or deterioration from exposure to the elements, cover with impervious sheet material. Provide ventilation to avoid condensation.

C. Store loose granular materials on clean, solid surfaces such as pavement, or on rigid sheet materials, to prevent mixing with foreign matter.

D. Provide surface drainage to prevent erosion and ponding of water.

E. Prevent mixing of refuse or chemically injurious materials or liquids.

3.4 MAINTENANCE OF STORAGE

A. Periodically inspect stored products on a scheduled basis.

B. Verify that storage facilities comply with manufacturer's product storage requirements.

C. Verify that manufacturer required environmental conditions are maintained continually.

D. Verify that surfaces of products exposed to the elements are not adversely affected; that any weathering of finishes is acceptable under requirements of contract documents.

3.5 MAINTENANCE OF EQUIPMENT STORAGE

A. For mechanical and electrical equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions shown on exterior of package.

B. Service equipment on a regularly scheduled basis, maintaining a log of services; submit as a record document.

END OF SECTION

SECTION 01 73 29

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements and limitations for cutting and patching of work.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Work by Owner or by separate contractors.
2. Section 01 62 00 - Product Options.
3. Individual Specifications Sections:
a. Cutting and patching incidental to work of the section.
b. Advance notification to other Sections of openings required in work of those sections.
c. Limitations on cutting structural members.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit written request in advance of cutting or alteration which affects:
1. Structural integrity of any element of the project.
2. Integrity of weather-exposed or moisture-resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight-exposed elements.
5. Work of Owner or separate contractor.

C. Include in request:
1. Identification of project.
2. Location and description of affected work.
3. Necessity for cutting or alteration.
4. Description of proposed work and products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner or separate contractor.
7. Written permission of affected separate contractor.
8. Date and time work will be executed.

1.3 PAYMENT FOR COSTS

A. Costs resulting from ill-timed or defective work, or work not conforming to contract documents, including costs for additional services of Architect or other consultants, shall be borne by the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Products: Those required for original installation.

B. For any change in materials, submit request for substitution under provisions of SECTION 01 62 00 - PRODUCT OPTIONS.

PART 3 - EXECUTION

3.1 GENERAL

A. Execute cutting, fitting, and patching including excavation and fill, to complete work, and to:
   1. Fit the several parts together, to integrate with other work.
   2. Uncover work to install ill-timed work.
   3. Remove and replace defective and non-conforming work.
   4. Remove samples of installed work for testing.
   5. Provide openings in elements of work for penetrations of mechanical and electrical work.

3.2 INSPECTION

A. Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

B. After uncovering, inspect conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.3 PREPARATION

A. Provide temporary supports to assure structural integrity of surroundings; devices and methods to protect other portions of project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

C. Maintain excavations free of water.

3.4 PERFORMANCE

A. Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

B. Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

C. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

D. Restore work with new products in accordance with requirements of contract documents.

E. Fit work tight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. At penetrations of fire-rated wall, ceiling, or floor construction, completely seal voids with fire-rated packing material, full thickness of the construction element.

G. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.

END OF SECTION

SECTION 01 74 13

CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Throughout the construction period, maintain the building and site in a standard of cleanliness as described in this section.

B. Related Requirements: In addition to standards described in this section, comply with requirements for cleaning as described in other pertinent sections of these specifications.

1.2 QUALITY ASSURANCE

A. Conduct a daily inspection, and more often if necessary, to verify that requirements for cleanliness are being met.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS AND EQUIPMENT

A. Provide required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

2.2 COMPATIBILITY

A. Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
1. Retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or drainage, and providing required protection of materials.
2. Do not allow accumulation of scrap, debris waste material, and other items not required for construction of the work.
3. At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the project site.
4. Provide adequate storage for all items awaiting removal from the project site, observing requirements for fire protection and protection of the ecology.

B. Site:
1. Daily, and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Weekly, and more often if necessary, inspect all arrangements of materials stored on the site. Restack, tidy, or otherwise service arrangements to meet the requirements of this section.
3. Maintain the site in a neat and orderly condition at all times.

C. Structure:
1. Weekly, and more often if necessary, inspect the structure and pick up all scrap, debris, and waste material. Remove such items to the place designated for their storage.
2. Weekly, and more often if necessary, sweep interior spaces clean.
   a. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and a hand-held broom.
3. As required preparatory to installation of succeeding materials, clean the structure or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using equipment and materials required to achieve the necessary cleanliness.

D. "Clean", for the purpose of this subparagraph shall be interpreted as meaning free from foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

3.2 FINAL CLEANING

A. "Clean", for the purpose of this Article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provide by skilled cleaners using commercial quality building maintenance equipment and materials.

B. Prior to completion of the work, remove from the project site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in this section.

C. Site:
1. Unless otherwise specifically directed by Architect, broom clean paved areas on the site and public paved areas adjacent to the site.
2. Completely remove resultant debris.

D. Structure:
1. Exterior:
a. Visually inspect exterior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed materials from adjacent surfaces.
c. If necessary to achieve a uniform degree of cleanliness, hose down the exterior of the structure.
d. In event of stubborn stains not removable with water, Architect may require light sandblasting or other cleaning at no additional cost to the Owner.
2. Interior:
a. Visually inspect interior surfaces and remove all traces of soil, waste materials, smudges, and other foreign matter.
b. Remove all traces of splashed material from adjacent surfaces.
c. Remove paint droppings, spots, stains, and dirt from finished surfaces.
3. Glass: Clean inside and outside.

E. Schedule final cleaning, as approved by the Architect, to enable the Owner to accept a completely clean work.

3.3 CLEANING DURING OWNER'S OCCUPANCY

A. Should the Owner occupy the work, or any portion thereof, prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning shall be as determined by the Architect in accordance with the General Conditions of the Contract for Construction.

END OF SECTION

SECTION 01 74 16

SITE MAINTENANCE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Restoration of site affected by the Work in public or private property, including pavement, esplanades, sidewalks, driveways, fences, lawns and landscaping.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for restoration of Project site disturbed by utility construction operations is on a linear foot basis. Measurement will be as provided for corresponding utility in each Specification section. No separate payment made for branch pipe, valves and, other associated work for utilities. Measurement for restoration with multiple utilities within the same right-of-way will be on a linear foot basis for only one utility.
2. No separate payment made for facility or roadway projects. Include cost in the surface improvements associated with the facility or roadway construction.
3. Payment includes required site restoration within the right-of-way or easement regardless of size or type of pipe, method of construction, paved or unpaved areas or thickness and width of pavement.
4. No separate payment made for site restoration for service connections under this Section. Include cost in appropriate utility section.
5. Refer to Division 1 for Unit Price procedures.

B. Stipulated Price (Lump Sum) Contracts. If Contract is Stipulated Price Contract, include payment for work under this section in total Stipulated Price.

1.3 DEFINITIONS

A. Phase: Locations identified on the plans and listed in Division 1.

B. Site Restoration: Replacement or reconstruction of Site Improvements located in rights-of-way, easements, public property, and private property affected or altered by the Work.

C. Site Improvement: Includes pavement, curbs and gutters, esplanades, sidewalks, driveways, fences, lawns, irrigation systems, landscaping, and other improvements in existence at the Project site before commencement of construction operations.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Schedule of testing, service connections, abandonment, backfill, and site restoration.
C. Sample of notices to residents outlining their responsibility for maintenance of site improvements adjacent to the Project that are not disturbed by construction operations.

1.5 SCHEDULING

A. Schedule testing, service connections, abandonment, backfill and site restoration immediately following completion of pipe laying work or paving within each block or line segment.

B. Phased Construction:

1. Commencement of subsequent Phase will follow scheduling of site restoration of prior Phase. Limit work to a maximum of two Phases of the project.

C. Construction of Projects with no Phases listed in Division 1:

1. Complete site restoration prior to disturbing over 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way or easement.
2. Limit work to a maximum of 50% of total project linear feet or 2,000 linear feet, whichever is greater, of right-of-way and easement. Commence work in additional right-of-way or easement after completion of site restoration.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Pavement, Sidewalks and Driveways: Materials specified in Division 32.

B. Seeding and Sodding: Sod specified in Division 32.

C. Trees, Shrubs and Plantings: Conform to requirements of Division 1.

PART 3 E X E C U T I O N

3.1 Preparatory Work

A. Provide cleanup and restoration crews to work closely behind pipe laying and roadway construction crews, and where necessary, during testing, service restoration, abandonment, backfill and surface restoration.

B. Water Lines: Unless otherwise approved by Owner’s Representative, comply with the following:

1. Once Owner’s Representative approves work within a Phase, immediately begin preparatory work for disinfection effort.
2. No later than three days after completing disinfection preparatory work, initiate disinfection work.
3. Immediately after transfer of services, begin abandonment of old water lines and site restoration.

C. Wastewater Lines:

1. Once Owner’s Representative approves work within a Line Segment, immediately begin preparatory work for testing effort.
2. No later than three days after completing preparatory work for testing, initiate testing work.
3. Immediately after transfer of service connections, begin abandonment of old wastewater lines, and site restoration.

D. Street Construction and Paving Projects

1. Once Owner's Representative approves work within a Line Segment or block, immediately begin preparatory work for testing effort.
2. No later than three days after completing preparatory work for testing, initiate testing work.
3. Immediately after testing begin site restoration.

E. Street Construction and Paving Projects

1. Once Owner's Representative approves work within a block, immediately begin preparatory work for sidewalk construction, sodding and hydromulching and tree planting.
2. No later than seven days after completing preparatory work, initiate construction.

3.2 CLEANING

A. Remove debris and trash to maintain a clean and orderly site in accordance with requirements of General Conditions and Division 1.

3.3 LANDSCAPING AND FENCES

A. Seeding and Sodding.

1. Remove construction debris and level area with bank sand so that new grass surface matches level of existing grass and maintains pre-construction drainage patterns. Level and fill minor ruts or depressions caused by construction operations with bank sand, where grass is still viable.
2. Restore previously existing turfed areas with sod and fertilize in accordance with Division 32. Sod to match existing turf.
3. Restore unpaved areas not requiring sodding with hydromulch seeding conforming to Division 32.

B. Trees, Shrubbery and Plants.

1. Remove and replant trees, shrubs, and plants in accordance with requirements of Division 1.

C. Fence Replacement.

1. Replace removed or damaged fencing to equal or better condition than existed prior to construction, including concrete footings and mow strips. Provide new wood posts, top and bottom railing and panels. Metal fencing material, not damaged by the Work, may be reused.
2. Remove and dispose of damaged or substandard material.

3.4 MAINTENANCE

A. Maintain shrubs, plantings, sodded areas and seeded areas.

B. Replace shrubs, plantings and seeded or sodded areas that fail to become established.

C. Refer to Division 1 for maintenance requirements.

END OF SECTION 01 74 16

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SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Disposal of waste material and salvageable material.

1.2 SUBMITTALS

A. Conform to requirements of Division 1.

B. Contractor shall obtain all required permits prior to disposal of excess material in areas designated as being in "100-year Flood Hazard Area."

C. Obtain and submit disposal permits for proposed disposal sites, if required by local ordinances.

D. Submit copy of written permission from property owner, with description of property, prior to disposal of excess material adjacent to Project. Submit written and signed release from property owner upon completion of disposal work.

E. Describe waste materials expected to be stored on-site and a description of controls to reduce Pollutants from these materials, including storage practices to minimize exposure of materials to storm water; and spill prevention and response measures in the Project's Storm Water Pollution Prevention Plan (SWPPP). Refer to Division 1.

PART 2 P R O D U C T S -Not Used

PART 3 E X E C U T I O N

3.1 SALVAGEABLE MATERIAL

A. Excavated Material: When indicated on Drawings, load, haul, and deposit excavated material at location or locations shown on Drawings outside limits of Project.

B. Base, Surface, and Bedding Material: Load shell, gravel, bituminous, or other base and surfacing material designated for salvage into Owner's designated trucks.

C. Pipe Culvert: Load culverts designated for salvage into Owner's designated trucks.

D. Other Salvageable Materials: Conform to requirements of individual Specification Sections.

E. Coordinate loading of salvageable material on Owner's trucks with Owner's Representative.

F. The Contractor shall dispose of all items the Owner refuses in conformance with the requirements of Division 1 at no additional cost to the Owner.

3.2 EXCESS MATERIAL

A. Remove and legally dispose of vegetation, rubble, broken concrete, debris, asphaltic concrete pavement, excess soil, and other materials not designated for salvage from job site.

B. Excess soil may be deposited on private property adjacent to Project when written permission is obtained from property owner. See Paragraph 1.02 D above.

C. Verify flood plain status of any proposed disposal site. Do not dispose of excavated materials in area designated as within 100-year Flood Hazard Area unless a permit has been obtained. Remove excess material placed in "100-year Flood Hazard Area" without a permit, at no additional cost to the Owner.

D. Remove waste materials from site daily, in order to maintain site in neat and orderly condition.

END OF SECTION 01 74 19

SECTION 01 77 00

CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for project closeout, including but not limited to:
   1. Inspection procedures.
   2. Project record document submittal.
   3. Operating and maintenance data submittal, including training sessions for equipment and systems.
   4. Submittal of warranties.
   5. Submittal of spare parts and maintenance materials.

B. Related Requirements:
   1. Section 01 11 00 - Summary of Work: record drawings.
   2. Section 01 33 23 - Shop Drawings, Product Data and Samples.
   3. Section 01 74 13 - Progress Cleaning: final cleaning.
   4. Section 08 71 00 - Door Hardware: keys and keying schedule.

1.2 SUBSTANTIAL COMPLETION

A. General: Substantial Completion is defined in Paragraph 9.8.1 of the General Conditions.

B. Preliminary Procedures: Before requesting inspection for certification of substantial completion, complete the following. List exceptions in the request.
   1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100% completion for the portion of the work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
      a. If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete construction and reasons the work is not complete.
   2. Advise Owner of pending insurance change-over requirements.
   3. Submit specific warranties, maintenance agreements, final certifications and similar documents.
   4. Obtain and submit releases enabling the Owner unrestricted use of the work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
   5. Submit record drawings, maintenance manuals and similar final record information.
   6. Deliver tools, spare parts, extra stock and similar items.
   7. Make final change-over of permanent locks and transmit keys and keying schedule to the Owner. Advise the Owner's personnel of change-over in security provisions.
   8. Complete start-up testing of systems, and training sessions for Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups and similar elements.
   9. Complete final clean-up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

C. Inspection Procedures: On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfulfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
   1. Architect will repeat the inspection when requested and assured that the work has been substantially completed.

D. Results of the completed inspection will form the basis of requirements for final acceptance.

1.3 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, submit the following. List exceptions in the request.
   1. Final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
   2. Updated final statement, accounting for final additional changes to the contract sum.
   3. Certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
   4. Consent of surety to final payment.
   5. Final Liquidated Damages settlement statement.
   6. Evidence of final, continuing insurance coverage complying with insurance requirements.
   7. Evidence of Compliance with Requirements of Governing Authorities
      a. Certificate of Occupancy.
      b. Certificates of Inspection required for mechanical and electrical systems.
   8. Operation and Maintenance Data: Under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.
   9. Warranties and Bonds: Under provisions of SECTION 01 78 30 - WARRANTIES AND BONDS.
   10. Project Record Documents: Under provisions of SECTION 01 78 39 - PROJECT RECORD DOCUMENTS.
   11. Spare Parts and Maintenance Materials: Under provisions of SECTION 01 78 40 - SPARE PARTS, OVERAGES AND MAINTENANCE MATERIALS.
   12. Keys and Keying Schedule: Under provisions of SECTION 08 71 00 - DOOR HARDWARE.
   13. Evidence of Payment and Release of Liens: In accordance with General Conditions of the Contract for Construction.
   14. Evidence of Payment of Debts and Claims: In accordance with General Conditions of the Contract for Construction.
   15. Certificate of Project Compliance: Required under provisions of Texas Administrative Code (TAC), Chapter 61, 1036(c)(3)(F). Form developed by the Texas Education Agency (TEA).
   16. Certification of Asbestos and Lead Free Project: The Contractor shall submit to the Architect a letter addressed to the Owner certifying that no materials used in the construction of this project contain lead nor asbestos materials in excess of amounts allowed by local/state standards, laws, codes, rules and regulations, Federal Environmental Protection Agency (EPA) standards and the Federal Occupational Safety and Health Administration (OSHA) standards, whichever are most restrictive. Certification shall further state that should lead or asbestos fibers be found in this project in concentrations greater than the allowed amounts, that the Contractor shall be responsible for determining which materials contain the lead or asbestos fibers and shall take corrective action to remove those materials from the project at no additional cost to the Owner. Final payment shall not be made until this letter of certification has
   17. Affidavits from all Subcontractors and Suppliers stating that no asbestos products have been installed in this project. The attached “Affidavit of Non-Asbestos, Lead, and PCB Use in Project” form must be notarized**.**

B. Re-inspection Procedures: Architect will re-inspect the work upon receipt of notice that the work, including inspection list items from earlier inspections, has been complete, except items whose completion has been delayed because of circumstances acceptable to the Architect.
   1. Upon completion of re-inspection, the Architect will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
   2. If necessary, re-inspection will be repeated.

C. Re-inspection Fees: Should status of completion of work require re-inspection by Architect due to failure of work to comply with Contractor's claims on initial inspection, Owner will deduct the amount of Architect and appropriate consultants’ compensation for re-inspection services from final payment to Contractor. The reimbursement transaction shall be executed by change order to the contract.

1.4 CLOSEOUT PROCEDURES

A. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size in digital format. Include the following types of information:
   1. Emergency instructions.
   2. Spare parts list.
   3. Copies of warranties.
   4. Wiring diagrams.
   5. Recommended "turn around" cycles.
   6. Inspection procedures.
   7. Shop drawings.
   8. Fixture lamping schedule.

B. Shop Drawings: Keep and maintain a full set of submittals throughout the construction phase to be submitted to the Architect with other close-out documents for delivery to the Owner for his permanent record. Set of submittals shall be delivered to the Architect in digital format. Organize submittals by CSI divisions, utilizing neatly labeled pressboard dividers to separate the sections. Neatly label short end of box with project name, contents and duration of construction.

C. Operating and Maintenance Training Sessions: Prepare a written agenda of items to be covered at each training session. Attendance by Owner's operating and maintenance personnel is mandatory. Notify Owner not less than 48 hours prior to scheduled training sessions.
   1. Arrange for each installer of equipment and systems that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
      a. Maintenance manuals.
      b. Record documents.
      c. Spare parts and materials.
      d. Tools.
      e. Lubricants.
      f. Fuels.
      g. Identification systems.
      h. Control sequences.
      i. Hazards.
      j. Cleaning.
      k. Warranties and bonds.
      l. Maintenance agreements and similar continuing commitments.
   2. Training sessions shall consist of not less than five days of not less than four hours each day. A copy of maintenance manuals for equipment or system being demonstrated shall be on hand during training session. As part of instruction for operating equipment, demonstrate the following procedures:
      a. Start-up.
      b. Shutdown.
      c. Emergency operations.
      d. Noise and vibration adjustments.
      e. Safety procedures.
      f. Economy and efficiency adjustments.
      g. Effective energy utilization.
   3. Training sessions shall be conducted for:
      a. Irrigation system.
      b. Food service equipment.
      c. Theatrical lighting control and distribution equipment.
      d. Elevator.
      e. HVAC systems.
      f. Energy management controls.
      g. Public address system.
      h. Fire alarm and smoke detection systems.
   4. Demonstration and Training in digital format
      a. General: Engage a qualified commercial photographer to record demonstration and training in digital format. Record each training session separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids.
      b. Digital Format: Provide high-quality color recording.

c. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to show area of demonstration and training. Display continuous running time.
d. Narration: Describe scenes by audio narration by microphone while being recorded. Include description of items being viewed. Describe vantage point, indicating location, direction (by compass point), and elevation or story of construction.
e. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from recording opposite the corresponding narration segment.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Format and content of manuals.
   2. Instruction of Owner's personnel.
   3. Schedule of submittals.

B. Related Requirements:
   1. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
   2. Section 01 45 00 - Quality Control: Manufacturer's instructions.
   3. Section 01 77 00 - Closeout Procedures.
   4. Section 01 78 30 - Warranties and Bonds.
   5. Section 01 78 39 - Project Record Documents.
   6. Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.2 QUALITY ASSURANCE

A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.3 FORMAT

A. Prepare data in the form of an instructional manual in digital/electronic format.

B. Arrange content by systems, under section numbers and sequence of table of contents of this project manual.

1.4 CONTENTS, EACH VOLUME

A. Table of Contents: Provide title of project; names, addresses, and telephone numbers of Architect/Engineer and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

B. For Each Product or System: List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

C. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

D. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use project record documents as maintenance drawings.

E. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in SECTION 01 45 00 - QUALITY CONTROL.

F. Warranties and Bonds: Bind in copy of each.

1.5 MANUAL FOR MATERIALS AND FINISHES

A. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional Requirements: As specified in individual specifications sections.

E. Provide a listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.6 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Give function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications.

C. Include as-installed color coded wiring diagrams.

D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

E. Maintenance Requirements: Include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

F. Provide servicing and lubrication schedule, and list of lubricants required.

G. Include manufacturer's printed operation and maintenance instructions.

H. Include sequence of operation by controls manufacturer.

I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

J. Provide as-installed control diagrams by controls manufacturer.

K. Provide Contractor's coordination drawings, with as-installed color coded piping diagrams.

L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

N. Additional Requirements: As specified in individual specifications sections.

O. Provide a listing in table of contents for design data, with tabbed fly sheet and space for insertion of data.

1.7 INSTRUCTION OF OWNER PERSONNEL

A. Before final inspection, instruct Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times. For equipment requiring seasonal operation, perform instructions for other seasons within six months.

B. Use operation and maintenance manuals as basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

C. Prepare and insert additional data in operation and maintenance manual when need for such data becomes apparent during instruction.

1.8 SUBMITTALS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within 10 days after acceptance.

C. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Architect/Engineer comments. Revise content of documents as required prior to final submittal.

D. Submit two copies of revised volumes of data in final form within 10 days after final inspection.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 78 30

WARRANTIES AND BONDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation and submittal of warranties and bonds.
2. Schedule of submittals.

B. Related Requirements:
1. Section 01 78 23 - Operation and Maintenance Data.
2. Section 01 78 39 - Project Record Documents.
3. Individual Specifications Sections: Warranties and bonds required for specific products or work.

1.2 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual in digital/electronic format.

B. Arrange content by systems, under section numbers and sequence of table of contents of this project manual. Provide full information, using separate typed sheets as necessary. List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

1.3 PREPARATION OF SUBMITTALS

A. Obtain warranties and bonds, executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the date of substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

1.4 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

B. Make other submittals within 10 days after date of substantial completion, prior to final application for payment.

C. For items of work when acceptance is delayed beyond date of substantial completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Maintenance and submittal of record documents and samples.

B. Related Requirements:
1. General Conditions of the Contract for Construction: Documents at the site.
2. Section 01 33 23 - Shop Drawings, Product Data, and Samples.
3. Section 01 77 00 - Closeout Procedures.
4. Section 01 78 23 - Operation and Maintenance Data.
5. Individual Specifications Sections: Manufacturer's certificates and certificates of inspection.

1.2 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. In addition to requirements in General Conditions, maintain at the site for Owner one record copy of:
1. Contract drawings.
2. Specifications.
3. Addenda.
4. Change orders and other modifications to the contract.
5. Reviewed shop drawings, product data, and samples.
6. Field test records.
7. Inspection certificates.
8. Manufacturer's certificates.

B. Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage for record documents and samples.

C. Label and file record documents and samples in accordance with section number listings in table of contents of this project manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

D. Maintain record documents in a clean, dry and legible condition. Do not use record documents for construction purposes.

E. Keep record documents and samples available for inspection by Architect.

1.3 RECORDING

A. Record information on a set of opaque drawings, and in a copy of a project manual. All changes made in these drawings in connection with the final construction and installation shall be neatly made in red ink on the prints.

B. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.

C. Contractor shall include with the record documents, all changes and modifications made by addenda, change orders, supplementary instructions, or other forms of documentation, written or verbal, which alter the documents.

D. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

E. Contract drawings and shop drawings: Legibly mark each item on the drawings to record actual construction, including:
   1. Measured depths of elements of foundation in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
   4. Field changes of dimension and detail.
   5. Changes made by addenda and modifications.
   6. Details not on original contract drawings.
   7. References to related shop drawings and modifications.

F. Specifications: Legibly mark each item in the specifications to record actual construction, including:
   1. Manufacturer, trade name, and catalog number of each product actually installed, particularly optional items and substitute items.
   2. Changes made by addenda and modifications.

G. Other Documents: Maintain manufacturer's certifications, inspection certifications, field test records, and other documents required by individual specifications sections.

H. Maintain these documents to reflect the current conditions of the work. Changes shall be reviewed on a monthly basis with the Architect's representative. The Contractor's updating of the "installed condition drawings" shall be a prerequisite to the monthly review of the Contractor's payment request by the Architect's representative.

1.4 SUBMITTALS

A. At contract closeout, deliver record documents and samples under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Transmit with cover letter in duplicate, listing:
   1. Date.
   2. Project title and number.
   3. Contractor's name, address, and telephone number.
   4. Number and title of each record document.
   5. Signature of Contractor or authorized representative.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 78 40

SPARE PARTS, OVERAGES AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Requirements Includes:
   1. Products required.
   2. Storage and delivery of products.

B. Related Requirements:
   1. Section 01 66 00 - Product Storage and Handling Requirements.
   2. Section 01 77 00 - Closeout Procedures.
   3. Section 01 78 23 - Operation and Maintenance Data.
   4. Individual Specifications Sections: Specific spare parts and materials required.

1.2 PRODUCTS REQUIRED

A. Provide quantities of products, spare parts, maintenance tools, and maintenance materials specified in individual sections to be provided to Owner, in addition to that required for completion of work.

B. Products: Identical to those installed in the work. Include quantities in original purchase from manufacturer to avoid variations in manufacture.

1.3 STORAGE, MAINTENANCE

A. Store products with products to be installed in the work, under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. When adequate, secure storage facilities are available at site, capable of maintaining conditions required for storage and not required for contract work or storage, or for Owner's needs, spare products may be stored in available space.

C. Maintain spare products in original containers with labels intact and legible, until delivery to Owner.

1.4 DELIVERY

A. Coordinate with Owner: Deliver and unload spare products to Owner’s Warehouse and obtain receipt prior to final payment.

B. For portions of project accepted and occupied by Owner prior to substantial completion, deliver a proportional part of spare products to Owner; obtain receipt.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

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SECTION 02 41 00

DEMOLITION

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Demolishing and removing existing pavement, structures, equipment, and materials as shown on the plans.

B. Disposal of demolished materials and equipment.

1.2 MEASUREMENT AND PAYMENT

A. Stipulated Price (Lump Sum). Contract is a Stipulated Price Contract, payment for Work In this Section is included in total Stipulated Price.

1.3 ENVIRONMENTAL CONTROLS

A. Minimize spread of dust and flying particles. If required by governing regulations, use temporary enclosures and other suitable methods to prevent the spread of dust, dirt, and debris.

B. Use appropriate controls to limit noise from demolition to acceptable levels.

C. Do not use water where it can create dangerous or objectionable conditions, such as localized flooding, erosion, or sedimentation of nearby ditches or streams.

D. Stop demolition and notify Engineer if underground fuel storage tanks, asbestos, PCB's, contaminated soils, or other hazardous materials are encountered.

E. Remove equipment and materials not designated for reuse or salvage and all waste and debris resulting from demolition from site. Dispose of removed equipment, materials, waste, and debris in a manner conforming to applicable laws and regulations.

PART 2 P R O D U C T S

2.1 EQUIPMENT AND MATERIALS FOR DEMOLITION

A. Fires shall not be permitted.

B. The use of a "drop hammer" shall not be permitted where the potential for damage to underground utilities exists.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Prior to demolition, make an inspection with Engineer to determine the condition of existing structures and features adjacent to items designated for demolition.

B. Engineer will mark or list existing equipment to remain on the property of the Owner.

C. Do not proceed with demolition or removal operations until after the joint inspection and subsequent authorization by Engineer.

3.2 PROTECTION OF PERSONS AND PROPERTY

A. Provide safe working conditions for employees throughout demolition and removal operations. Observe all safety requirements for work below grade.

B. Maintain safe access to adjacent property and buildings at all times. Do not obstruct roadways, sidewalks, or passageways adjacent to the work.

C. Perform demolition in a manner to prevent damage to adjacent property. Repair damage to Owner's property or adjacent property and facilities.

D. The Contractor shall be responsible for the safety and integrity of adjacent structures and shall be liable for any damage due to movement or settlement. Provide proper framing and shoring necessary for support. Cease operations if an adjacent structure appears to be endangered. Resume demolition only after proper protective measures have been taken.

E. Erect and maintain enclosures, barriers, warning lights, and other required protective devices.

3.3 UTILITY SERVICES

A. Follow rules and regulations of authorities or utility companies having jurisdiction over water, natural gas, electricity, or telephone services.

B. Notify and coordinate with utility company and adjacent building occupants when temporary interruption of utility service is necessary.

C. Call before you dig (locates) to be coordinated by contractor.

D. Notify owner of demolition schedule to allow owner sufficient time to locate.

3.4 DISPOSAL

A. Remove from the site all items contained in or upon the structure not designated for reuse or salvage.

B. Follow method of disposal as required by regulatory agencies.

3.5 BACKFILL

A. Backfill holes in accordance with specification sections governing materials indicated on Drawings. Where no material is indicated, backfill with approved borrow and compact to density of adjacent soil.

B. Do not backfill with material from demolition unless approved by Engineer.

END OF SECTION 02 41 00

SECTION 02 41 13.10

REMOVING EXISTING PAVEMENT AND STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removing concrete paving, asphaltic concrete pavement, and base courses.
B. Removing concrete curbs, concrete curbs and gutters, sidewalks, and driveways.
C. Removing pipe culverts and sewers.
D. Removing existing inlets and manholes.
E. Removing miscellaneous structures of concrete or masonry.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Payment for removing and disposing of asphaltic surfacing and unreinforced concrete base under asphaltic surfacing, regardless of the thickness encountered, is on a square yard basis measured between lips of gutters.
2. Payment for removing and disposing of concrete base under surfacing with curbs, regardless of the thickness encountered, is on a square yard basis measured from back-to-back of curbs. Payment includes removal of all concrete base, asphaltic surfacing, concrete pavement, esplanade curbs, curb and gutters, and paving headers.
3. Payment for removing and disposing of reinforced concrete pavement, regardless of its thickness, is on a square yard basis measured from back-to-back of curbs. Payment includes concrete pavement, esplanade curbs, curbs and gutters, and paving headers.
4. Payment for removing and disposing of monolithic curbs and gutters, and concrete curbs, is on a linear foot basis measured along the face of the curb.
5. Payment for removing and disposing of cement stabilized shell base course, with or without asphaltic surfacing, is on a square yard basis.
6. Payment for removing and disposing of concrete sidewalks is on a square yard basis.
7. Payment for removing and disposing of concrete driveways is on a square yard basis.
8. Payment for removing and disposing of miscellaneous concrete and masonry is on a cubic yard basis of the structure in place.
9. Payment for removing and disposing of pipe culverts and sewers is on a linear foot basis for each diameter and each material type of pipe removed.
10. Payment for removing and disposing of existing inlets is on a unit price basis for each inlet removed.
11. Payment for removing and disposing of existing manholes is on a unit price basis for each manhole removed.
12. Payment for saw cutting of existing pavement is on a linear foot basis.
13. No payment will be made for work removed with out the Engineer’s approval or for pavements or structures removed for the Contractor's convenience.

B. 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 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.
B. Coordinate removal work with utility companies.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Obtain advance approval from Engineer for dimensions and limits of removal work.
B. Identify known utilities below grade. Stake and flag locations.

3.2 PROTECTION

A. Protect the following from damage or displacement:

1. Adjacent public and private property.
2. Trees, plants, and other landscape features designated to remain.
3. Utilities designated to remain.
4. Pavement and utility structures designated to remain.
5. Bench marks, monuments, and existing structures designated to remain.

3.3 REMOVALS

A. Remove pavements and structures by methods that will not damage underground utilities. Do not use a drop hammer near existing underground utilities.
B. Minimize amount of earth loaded during removal operations.
C. Where existing pavement is to remain, make straight saw cuts in existing pavement to provide clean breaks prior to removal. Do not break concrete pavement or base with drop hammer unless concrete or base has been saw cut to a minimum depth of two (2) inches.
D. Where street and driveway saw cut locations coincide or fall within three (3) feet of existing construction or expansion joints, break out to existing joint.
E. Remove sidewalks and curbs to nearest existing dummy, expansion, or construction joint.
F. Where existing end of pipe culvert or end of sewer is to remain, install an 8-inch thick masonry plug in pipe end prior to backfill.

3.4 BACKFILL

A. Backfill of removal areas shall be in accordance with requirements of Division 31.

3.5 DISPOSAL

A. Inlet frames, grates, plates, and manhole frames and covers may remain property of the Owner. Disposal shall be in accordance with requirements of Section 01 74 19 – Construction Waste Management and Disposal.
B. Remove from the site debris resulting from work under this section in accordance with requirements of Section 01 74 19 - Construction Waste Management and Disposal.

END OF SECTION 02 41 13.10

SECTION 02 41 16

STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Demolition, removal, and disposal, off site, of all items noted, including existing debris, rubbish, and trash.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: instructions concerning asbestos.
2. Section 01 50 00 - Temporary Facilities and Controls: Protection of existing fiber optics line and other underground utilities.
3. Section 31 10 00 - Site Clearing.
4. Section 31 23 00 - Excavation and Fill.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Schedule: Submit proposed schedule of operations coordination for shutoff, capping, and continuation of utility services. Provide a detailed sequence of demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.

C. Photographs: Submit photographs of existing adjacent structures and site improvements.

D. Submit written documents showing conflicts of existing piers with new pier locations.

1.3 PROJECT CONDITIONS

A. Contractor shall visit the project site and verify the nature and extent of demolition required.

B. Occupancy: Structures to be demolished will be vacated and use discontinued prior to start of work.

C. Conditions of Structures: Owner assumes no responsibility for actual condition of structures to be demolished.
1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner insofar as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

D. Salvaged Materials: Items of salvageable value to Contractor may be removed from structure as work progresses.
1. Transport salvaged items from site as they are removed.
2. Storage or sale of removed items will not be permitted on site.

E. Explosives: Use of explosives will not be permitted.

F. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, or other occupied or used facilities without Owner's permission.

G. Protections: Ensure safe passage of persons around area of demolition. Conduct operations to prevent damage to adjacent buildings, structures, and other facilities and injury to persons.
1. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structures to be demolished and adjacent facilities to remain.

H. Damages: Promptly repair damages caused to adjacent facilities by demolition operations.

I. Utility Services: Maintain existing utilities indicated to stay in service and protect against damage during demolition operations.
   1. Refer to Divisions 22, 23, and 26 for disconnecting, removing, and capping of utility services. Do not start demolition work until utility disconnections have been completed and verified in writing.
   2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by Owner. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.

PART 2 - PRODUCTS - Not used.

PART 3 - EXECUTION

3.1 DEMOLITION

A. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising and scattering in air.
   1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
   2. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to start of work.

B. Building Demolition: Demolish building completely and remove from site.
   1. Proceed with demolition in systematic manner, from top of structure to ground.
   2. Demolish concrete and masonry in small sections.
   3. Remove structural framing members and lower to ground by hoists, derricks, or other suitable methods.
   4. Break up and remove concrete slabs-on-grade.
   5. Locate demolition equipment throughout structure and remove materials so as to not impose excessive loads to supporting walls, floors, or framing.

C. Below-grade Construction: Demolish foundation walls and other below-grade construction, including concrete slabs, to a depth of not less than 1'-0" below lowest foundation level.
   1. Completely fill voids resulting from demolition of structures.
   2. Prior to placement of fill materials, ensure that areas to be filled are free of standing water, frost, frozen material, trash and debris.
   3. Place fill materials in horizontal layers not exceeding 9" in loose depth. Compact each layer at optimum moisture content of fill material to a density equal to original adjacent ground, unless subsequent excavation for new work is required.
   4. After fill placement and compaction, grade surface to meet adjacent contours and to provide flow to surface drainage structures.

3.2 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove weekly from site accumulated debris, rubbish, and other materials resulting from demolition operations.

B. Burning of combustible materials from demolished structures will not be permitted on site.

C. Removal: Transport materials removed from demolished structures and legally dispose off site.

END OF SECTION

SECTION 02 41 19

SELECTIVE STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Taking down, cutting away, breaking out and removing portions of the existing buildings to accommodate new construction.
2. Disconnecting, capping and removing identified utilities.
3. Offsite disposal and/or salvaging for reinstallation, indicated components.

B. Related Requirements:
1. Section 01 11 00 - Summary of Work: Instructions concerning hazardous materials.
2. Section 01 35 00 - Alteration Project Procedures: Re-installation of removed materials.
3. Section 01 50 00 - Temporary Facilities and Controls: Barricades; Dust control.
4. Section 01 78 39 - Project Record Documents.

1.2 SUBMITTALS

A. Submit demolition and removal procedures and schedule under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Submit record documents under provisions of SECTION 01 78 39 - PROJECT RECORD DOCUMENTS. Accurately record actual locations of capped utilities and subsurface obstructions.

1.3 PROJECT CONDITIONS

A. Occupancy: Owner will be continuously occupying portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's operations.

B. Existing Conditions: Owner assumes no responsibility for actual condition of items or structures to be demolished. Contractor shall visit the buildings and verify the nature and extent of demolition required. Conditions existing at time of commencement of contract will be maintained by Owner insofar as practicable. However, variations within structures may occur by Owner's removal and salvage operations prior to start of selective demolition.

C. Property Protection: Contractor shall be responsible for the protection of adjoining property, including all parts of the building outside the limits of demolition and site improvements outside the limits of the new construction.

1.4 EXISTING CONDITIONS

A. Conduct demolition to minimize interference with adjacent portion of structures to remain.

B. Conduct operations with minimum interference with Owner's usage of buildings. Maintain protected egress and access at all times and maintain protected egress at fire exits as required by the Fire Marshall.

1.5 PROTECTION

A. It is essential that there be minimal interruptions of existing mechanical and electrical systems in addition to the normal operation of Owner's facilities.

B. Take care to ensure that there will be no damage to elements or portions thereof which are not required to be removed. Erect and maintain temporary shoring, bracing, and other means to safeguard the structural integrity of the existing portions of building and its parts to remain.

C. Erect and maintain temporary bracing, shoring, lights, barricades, signs and other means to protect workers and other persons, and finishes and improvements to remain from damage; all in accordance with applicable regulatory requirements.

D. Erect and maintain temporary barriers to confine dust and debris.

E. Protect existing trees to remain. Keep area within the drip line clear of construction traffic, parking, soil contamination, soil stockpiling, storage of materials, debris and ponding water.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials designated for demolition shall become the Contractor's property; remove and dispose of such materials unless otherwise indicated or specified. Sales of salvage materials are not allowed on site.

B. Furnishings and equipment items to remain the Owner's property will be removed by him prior to the start of demolition (or will be designated on the drawings herein or to be removed and stored by Contractor). Items not so designated shall be considered debris and shall be removed and disposed of accordingly.

C. Carefully disconnect, remove and protect items directed by the Owner to be salvaged.

D. Transport salvaged items to on-site storage areas designated by the Owner.

PART 3 - EXECUTION

3.1 INSPECTIONS

A. Prior to starting demolition, make inspection and report observable defects and structural weaknesses of construction designated for demolition, of adjacent structures, and of improvements to remain. If unsatisfactory conditions exist, do not commence demolition until appropriate determinations have been made.

B. Following demolition, make inspection and report defects and structural weaknesses of items partially demolished, cut, or removed, of adjacent structures; and of improvements remaining.

3.2 PREPARATION

A. Cover and protect furniture, equipment and fixtures to remain from soiling or damage when demolition work is performed in rooms or areas from which such items have not been removed.

B. Prevent movement or settlement of adjacent structures. Provide bracing, shoring and underpinning as required.

C. Protect existing appurtenances, structures and landscaping which are not to be demolished.

D. Locate, disconnect, remove and cap designated utility lines within demolition areas.

E. Mark location of disconnected utilities. Identify utilities and indicate capping locations on project record documents.

F. Provide weatherproof closures for exterior openings resulting from demolition work.

3.3 PERFORMANCE

A. Demolition: Carry out the work carefully and in an orderly manner to minimize interference with the daily operations in the building and to avoid damage to permanent parts of the building and the equipment therein. Hold noise, dust and vibration to a minimum. Remove all items and parts so shown and noted on the drawings and as otherwise may be required to be removed to carry out the work.

B. Shoring: Provide temporary shoring for walls and framing wherever present supports are removed or weakened. Any settling or cracking of the existing construction due to the removal of supports and faulty or insufficient shoring shall be the responsibility of the contractor and shall be repaired at no additional expense to the Owner.

C. Material and Equipment Disposal:
   1. The materials and items of equipment which are noted and shown to be salvaged and re-used in new locations or re-used for patching shall be carefully removed and safely stored until ready for reinstallation.
   2. Other items and all debris shall become the property of the Contractor and shall be removed from the premises entirely. Under no circumstances shall debris be allowed to accumulate.

D. Damage: Any existing construction to be left in place which is damaged by the demolition operations shall be refinished or replaced at no additional expense to the Owner. The repair of such damage shall leave the parts in a condition at least equal to that found at the start of the work.

E. Perform demolition in accordance with ANSI A10 - Construction and Demolition Standards, ANSI A10.6 – Safety and Health Program Requirements for Demolition Operations, and applicable regulatory requirements.

F. Remove items designated for demolition within the limits of work indicated and as required to perform the work. Do not remove anything beyond the limits of demolition indicated without the prior written approval of Architect. If in doubt whether to remove an item, obtain written approval prior to proceeding.

G. If in the event hazardous materials (asbestos, PCB's etc.) are encountered during the course of the demolition work, or if it is even suspected that such materials will or have been encountered cease work immediately in the affected area and promptly notify the Owner and Architect.

3.4 CUTTING

A. Make new openings neat, as close as possible to profiles indicated and only to extent necessary for new work.

B. Do not cut or alter structural members unless specifically indicated or approved, and do not damage reinforcing or structural steel to remain.

C. At concrete, masonry, paving and other materials where edges of cuts and holes will remain exposed in the completed work, make cuts using power-sawing and -coring equipment. Do not over-cut at corners of cut openings.

D. Upon completion of cutting and coring, clean remaining surfaces of loose particles and dust.

3.5 PIPES, DUCTS AND CONDUITS

A. Remove deactivated mechanical, plumbing and sprinkler piping, ducts and electrical conduit, including fastenings, connections and other related appurtenances and accessories which would otherwise be exposed in the completed work or interfere with construction operations.

B. These facilities above ceilings may remain in place if their presence does not result in interference with new work, in which case they shall be removed to extent necessary.

C. Cap deactivated piping systems at points of cutoff.

3.6 RECONDITIONING EXISTING SUBSTRATES

A. Clean surfaces on which new materials will be applied, removing adhesives, bitumen and other adhering materials, as necessary to furnish acceptable substrates for new materials.

B. Perform sandblasting, chipping, grinding, acid washing, etching and other work as required by conditions encountered and new materials involved.

C. Use of acids or other cleaning agents shall include neutralizing, washing, rinsing and drying, as applicable.

D. Determine substrate requirements for reconditioned surfaces in cooperation with the manufacturer's representative and installer of each new material involved.

3.7 CLEAN UP

A. Upon completion of demolition work, remove tools, equipment and demolished materials from site. Remove protections and leave interior areas broom clean.

END OF SECTION

SECTION 03 11 00

CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Formwork with accessories for the cast-in-place concrete and permanent shoring.

B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 07 26 00 - Vapor Retarders.

1.2 QUALITY ASSURANCE

A. Standard: Formwork shall meet the requirements of ACI 347.

B. Surface Tolerances: Allowable tolerances for formed concrete surfaces shall be ⅜" maximum in 20 feet for vertical surfaces out of plumb and ¼" maximum in 20 feet for horizontal surfaces out of plane.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Lumber: S2S&CM or S2S&SL No. 3 Boards or better Southern Pine not less than a nominal 1" thick.

B. Plywood: EXT-APA grade-trademarked B-B Plyform, Class I, or High Density Overlaid Plyform, Class I. B-B Plyform shall be sanded but not mill oiled. Plywood shall be new.

C. Expansion Joint Filler:
1. Concealed: ASTM D 1751, asphalt saturated cane fiberboard.
2. Exposed: ASTM D 1752, Type I, premolded, non-bituminous, closed cell sponge rubber. Color to be stone gray.

2.2 ACCESSORIES

A. Form Ties: Form ties for exposed concrete surfaces shall be manufactured to allow a positive breakback of at least 1" inside the concrete surface. Ties shall be equipped with a plastic cone or washer not less than 1" in diameter and 1" long which will cover the hole and prevent leakage of mortar. Form ties for unexposed surfaces shall be bolt rods or patented devices having a minimum tensile strength of 3000 pounds when fully assembled. Ties shall be adjustable in length and free of lugs, cones, washers or other features which would leave a hole larger than ⅞" in diameter, or depressions back of the exposed surface of the concrete. Ties shall be of such construction that, when the forms are removed, there will be no metal remaining within 1" of the finished surface of the concrete.

B. Form Release Agent: Colorless material which will not stain concrete, absorb moisture or affect bond of subsequent surface finish manufactured by Nox-Crete, Symons, or approved equivalent.

C. Plastic Waterstops: Multiple rib strips of PVC resin 3/8” thick and 6” wide. Product/manufacturer; one of the following:
Type 5; Grace Construction Products
No. 705; Greenstreak Plastic Products
RB6-38; Vinylex Corp.

PART 3 - EXECUTION

3.1 FORMWORK

A. General: Construct forms in compliance with referenced standard. All forms, shores, falsework, bracing and other temporary supports shall be engineered by the Contractor to support all loads imposed during

construction, including weight of construction equipment, allowance for live loads and lateral forces due to wind and temporary imbalance of discontinuity of building components.

B. Construction: Construct forms to the dimensions and shapes of the concrete members as detailed and scheduled; and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Set, assemble and brace forms to withstand wet concrete construction loads without deflection, movement, or leakage. Provide access for placing and adjusting reinforcement and cleaning forms.
   1. Exposed Surfaces: Form with plywood the non-wearing concrete surfaces exposed to view. On these surfaces locate the form ties in uniform patterns. The joints shall be tight and flush. Plywood may be re-used only with the specific approval of the Architect. Chamfer exposed outside corners.
   2. Concealed Surfaces: Form with wood or metal forms the concealed vertical surfaces of grade beams and walls below grade.

C. Inserts and Fasteners: Provide for the installation of inserts, conduits, sleeves, drains, hangers, nosings, metal reglets, nailing strips, and like items required for the attachment of other work and furnished by other trades. Properly locate in cooperation with other trades and secure in position before concrete is placed.

D. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

3.2 EARTH FORMS

A. Earth forms are not permitted.

3.3 REMOVAL OF FORMS

A. Remove forms with sufficient care to avoid scarring exposed surfaces. Prying against face of concrete will not be permitted. Remove forms completely so that no wood form material is left in contact with concrete.
   1. General: Formwork for walls, sides of beams, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations, but in no event before concrete is 24 hours old. Whenever the formwork is removed during the curing period, the exposed concrete shall be cured.

3.4 FIELD QUALITY CONTROL

A. Inspect erected formwork to ensure that work is in accordance with formwork design, and that supports, fastenings, wedges, ties, and items are secure.

B. Do not reuse wood formwork more than three times for concrete surfaces to be exposed to view. Do not patch formwork.

3.5 FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 301.

END OF SECTION

SECTION 03 20 00

CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Reinforcement with accessories for the cast-in-place concrete.
2. Reinforcing steel bars and welded steel wire fabric for cast-in-place concrete.
3. Support chairs, bolsters, and spacers, for supporting reinforcement.

B. Related Sections:
1. Section 03 11 00 - Concrete Forming and Accessories.
2. Section 03 30 00 - Cast-in-Place Concrete.
3. Section 04 20 00 - Masonry Units: Reinforcement for masonry.
4. Section 31 63 29 - Drilled Concrete Piers.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Drawings shall show the size, length, form and position of bar reinforcing and accessories.

B. Certification: Submit a letter certifying that reinforcing bars comply with specified standard for grade.

1.3 QUALITY ASSURANCE

A. Standard: Reinforcement shall meet the requirements of ACI 318 Building Code Requirements for Structural Concrete.

1.4 DELIVERY AND STORAGE

A. Stack reinforcing steel in tiers and mark so that each length, size, shape and location can be readily determined. Exercise care to maintain reinforcement free of dirt, mud, paint or rust.

B. Store materials and accessories on dunnage and under protective sheeting.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars: ASTM A 615, Grade 60 deformed billet steel.

B. Reinforcing Fabric: ASTM A 185, welded steel wire fabric in flat sheets.

C. Tie Wire: 16 gage annealed steel wire.

D. Accessories: Anchors, dowels, spacers, chairs, bolsters and other devices for supporting and fastening reinforcement and normally considered as accessories to the concrete work.

2.2 FABRICATION

A. Fabricate reinforcing bars to conform to the required shapes and dimensions, with fabrication tolerances complying with the CRSI Manual.

B. In case of fabricating errors, do not straighten or re-bend reinforcement in a manner that will weaken or injure the material.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Placing Steel:
1. Place reinforcement in accordance with CRSI "Placing Reinforcing Bars" and ACI 318, with provisions of ACI 318 governing.
2. Assemble reinforcing steel in the forms, wired and fastened securely. Bending shall be done cold. Bars with kinks or bends not detailed shall be rejected.
3. Clean reinforcing steel of loose rust, mill scale, grease, dirt and other coatings which will reduce or destroy bond with the concrete. A thin film of tight rust will not be objectionable.
4. Position, support, and secure reinforcement to resist displacement by formwork, construction, and concrete placing operations.
5. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers.
6. Place reinforcement to obtain minimum coverages for concrete protection.
7. Arrange, space, and securely tie bars and bar supports together with the specified tie wire.
8. Set wire ties so twisted ends are directed away from exposed concrete surfaces.
9. Support reinforcement and fasten together to prevent displacement by construction loads of placing concrete. Use No. 16 gauge black annealed wire at all joints and crosses to accurately position reinforcement in place.
10. Use metal or plastic bar chairs and spacers to support reinforcement.
11. Where concrete surface will be exposed to weather in finished structure, use non-corrosive or corrosion protected accessories within ½" of concrete surface.
12. Bars having splices not shown on shop drawings will be subject to rejections.
13. Do not bend reinforcement after being embedded in hardened concrete.
14. Do not allow bars to be in contact with dissimilar materials.

3.2 FIELD QUALITY CONTROL

A. Inspection and Evaluation: The testing and inspection laboratory shall inspect placement of all reinforcing steel to confirm compliance with the contract documents.

B. Concrete shall not be poured without inspection approval as noted above.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast-in-place concrete, including mixing, placing, and finishing.

B. Related Sections:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 03 10 00 - Concrete Forming and Accessories.
3. Section 03 20 00 - Concrete Reinforcing.
4. Section 07 26 00 - Vapor Retarders.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit product data for admixture, bonding compound, curing compound, grout, and sealer.

C. Design Mixes:
1. At the beginning of the work, Contractor shall submit proposed concrete mix designs for review by the Architect, structural engineering consultant, and testing laboratory per SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
   a. Include the sieve analysis of fine and course aggregate ASTM C 136, dry rodded weight of coarse aggregate - ASTM C 29, and the specific gravity (bulk saturated surface dry), of fine and coarse aggregates ASTM C 127 and C 128.
   b. State admixture used and project conditions required for specific admixtures.
   c. Proposed concrete mix design shall also include the results of compressive tests.
2. Contractor shall not mix concrete for placing in the work until confirmation laboratory reports are supplied to reflect that each proposed mix will develop the strength and slump required. Successful past history in accordance with ACI 318 will be satisfactory.

1.3 QUALITY ASSURANCE

A. Standard: Concrete shall meet the requirements of ASTM C 94.

B. Perform work in accordance with ACI 301, 304, 305, 306, and 309.

C. Obtain materials from same source throughout the work.

D. Batch plant shall be able to show a minimum of five-years experience in batching concrete. If required, they shall furnish a list of similar sized jobs or special condition jobs performed during the last two-years.

E. Surface Tolerances: For all finished concrete wearing surfaces, the variation from level or from elevations indicated shall not exceed ¼" in 16'. If variations exceed those as set forth then the wearing surface shall be filled or ground down as required to meet the stated tolerances.

1.4 PROJECT CONDITIONS

A. Environmental Requirements:
1. Cold Weather Placing: Do not place concrete when the temperature is below 40°F. or is expected to fall below 40°F. within 24 hours after placing concrete; unless either favorable weather is forecast or adequate arrangements for protection and heating have been made in accordance with ACI 306.
2. Hot Weather Placing: Do not place concrete when hot weather conditions exist that would impair the quality and strength of concrete, i.e. any combination of high air temperature, low relative humidity, and wind velocity, unless adequate arrangements for protection have been made in accordance with ACI 305.

B. Coordination: Notify other trades and contractors well in advance of placing concrete to allow them sufficient time in which to install work which is to be built-in or cast into the concrete.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cements: ASTM C 150, Type I, domestic manufacture.

B. Fine Aggregate: ASTM C 33, washed sand with a fineness modulus of between 2.50 and 3.00.

C. Coarse Aggregate: ASTM C 33, clean crushed stone or washed gravel. The nominal maximum particle size shall not exceed 1/5 of the narrowest dimension between forms or ¾ of the minimum clear spacing between reinforcing bars.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494, Type A.
   2. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.

E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures, equal to Master Builders "Micro Air", a BASF Chemical Company.

F. Fly Ash - ASTM C 618, Type C or Type F, limit use of fly ash to not-to-exceed 25% of cement content by weight.

G. Water: Clean and potable.

2.2 CONCRETE TREATMENT PRODUCTS

A. Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, clear, acrylic copolymer based liquid for curing and sealing concrete. Product/manufacturer; one of the following:
   Safe-Cure Clear; ChemMasters ClearDR
   Diamond Clear VOX; Euclid Chemical Co.
   Cure & Seal 1315 LVOC; Symons Corp., a Dayton Superior Co.
   Vocomp-20; W.R. Meadows, Inc.

B. Concrete Sealer at Interior Exposed Concrete: Refer to Section 03 35 46.

C. Non-metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, non-metallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and 30-minute working time. Product/manufacturer; one of the following:
   NS Grout; Euclid Chemical Co.
   Sealtight 588 Precision Grout; W.R. Meadows, Inc.
   Sonogrout® 10K; Master Builders, a BASF Chemical Company

D. Re-surfacing and/or Self-Leveling Underlayment Material: Provide Ardex K-15 as distributed by Ardex, Inc. (phone 888.512.7339, www.ardex.com) or Super Flo-Top as manufactured by The Euclid Chemical Co.

2.3 SELECTING PROPORTIONS FOR CONCRETE

A. Strength: Select proportions for a mix designed to produce concrete with a minimum 28-day compressive strength of 3000 psi, unless noted otherwise in the Contract Documents.
   1. Reference Civil drawings and specifications for strength required at paving.

B. Admixture:
   1. Use admixture in all concrete. Select the type (normal, retarder, or high early) best suited for the temperature conditions at the time the concrete is placed and finished.
   2. Use water reducing admixture only with the permission of the Engineer. Do not use water reducing admixture and air entrainment together with any slabs to receive a hard trowelled finish. Use air entrainment in all concrete to be pumped (5%).

C. Use air-entraining admixture in all exterior concrete, including pavement and flatwork. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content by volume with a tolerance of plus or minus 1½ percent within the following limits:

1. 3 to 6 percent, 1½" max. aggregate.
2. 3.5 to 6.5 percent, 1" max. aggregate.
3. 4 to 8 percent, ¾" max. aggregate.
4. 5 to 9 percent, ½" max. aggregate.

D. Calcium chloride shall not be used.

E. Slump: Select proportions to produce concrete with the following maximum allowable slumps. The slump limits given shall apply after inclusion of the admixture.

Reinforced piers, footings	5" +/- 1”
Reinforced walls, beams, slabs	6" +/- 1”
Pavement, flatwork	4" +/- 1”

2.4 MIXING AND DELIVERY

A. Measurement of concrete materials, mixing, and delivery of fresh concrete to the project shall meet the requirements of ASTM C 94. Transit-mixed concrete supplier shall have a plant with sufficient capacity and transportation facilities to assure continuous delivery at the rate required.

B. Mix concrete in accordance with ASTM C 94, Alternative No. 2, or ACI 304.

C. Deliver concrete in accordance with ASTM C 94.

D. Select proportions for normal weight concrete in accordance with ACI 301 Method 1. Mix not less than one minute after materials are in mixer.

E. Do not transport or use concrete after 90 minutes has expired from time of initial mixing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before any concrete is placed, the forms and reinforcement shall be inspected by the Contractor and the Owner’s testing laboratory. Notify the Owner’s testing laboratory not less than one working day before concrete is scheduled to be placed. Bucks, sleeves, anchors and other fixtures to be embedded in concrete shall be properly positioned and anchored. Wash down form surfaces to remove foreign substances. Provide elevated runways clearing steel and other embedded work.

B. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's instructions.

C. At locations where new concrete is doweled to existing work, drill over-sized holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.

3.2 CONVEYING CONCRETE

A. Convey concrete to the place of final deposit by methods which will prevent the separation or loss of the ingredients. Equipment for chuting, pumping, and pneumatically conveying concrete shall be such as to assure a continuous flow of concrete at the delivery end without separation. The use of aluminum chutes or pipes for transporting concrete will not be permitted.

3.3 PLACING CONCRETE

A. Notify Architect and testing laboratory a minimum of 24 hours prior to commencement of concreting operations.

B. General: Place concrete in continuous horizontal lifts no deeper than 24". Avoid inclined lifts and inclined construction joints and do not cause or allow concrete to flow horizontally in the forms. Keep conveying equipment clean and free of hardened concrete. Use tremies or suitable chutes for placing concrete in high narrow walls so that concrete will not have a free vertical fall in excess of 3'.

C. Place concrete in accordance with ACI 301 and as specified below:
   1. Unless protection is provided, do not place concrete in rain, sleet, or snow.

2. Regulate rate of placement so concrete remains plastic and flows into position.
3. Deposit concrete continuously until panel or section is completed. Place as near as possible to its final location; do not rehandle.
4. Do not place concrete, under any circumstances, except in presence of testing laboratory.
5. When placing concrete in masonry, exercise extreme care to prevent concrete from staining face of masonry.
6. Consolidation
   a. Comply with requirements of ACI 309.
   b. Use mechanical vibrating equipment for consolidation.
   c. Do not use vibrators to transport concrete in forms.
   d. Use vibrators with sufficient speed and amplitude to consolidate effectively.
   e. Keep a spare vibrator on site during all concrete pours.
   f. Thoroughly consolidate concrete and work around reinforcement, embedded items and into corners of forms. Thoroughly consolidate layers of concrete with previous layers.
7. Expansion Joint Fillers: Place pre-molded expansion joint fillers at locations as detailed and whenever required to separate site paving from building slabs. Refer to Drawings for required joint dimensions. Reference SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES for joint filler products.
8. Bonding: Before depositing any new concrete on or against previously deposited concrete which has partially or entirely set, thoroughly roughen and clean the surfaces of the latter of all foreign matter, scum, and laitance. Re-tighten forms and re-coat the surface of the previously deposited concrete with specified bonding agent per manufacturer's directions.

D. Ensure reinforcement, inserts, embedded parts, and formed joints are not disturbed during concrete placement.

E. Place concrete continuously between predetermined construction and control joints. Do not break or interrupt successive pours such that cold joints occur.

F. Saw cut control joints at an optimum time after finishing. Use 1/4" thick blade, cutting 1/4 into depth of slab thickness.

G. Separate exterior slabs on fill from vertical surfaces with joint filler. Extend joint filler from bottom of slab to within ¼" of finished slab surface.

H. Excessive honeycomb or embedded debris in concrete is not acceptable. Notify Architect/Engineer upon discovery.

I. Maintain record of concrete placement. Record date, location, quantity, air temperature and test samples taken.

J. Slabs: Place each slab in one continuous operation without joints within the area established for a continuous pour. Start placing at the far end of the area and place each load of concrete against previously placed concrete, not away from it.

K. Compaction: Compact concrete with ramming and spading tools during placing to work the coarse aggregate away from the forms and to produce a dense mass without air pockets. Work concrete through and around reinforcing steel. Do not disturb any embedded work.

L. Consolidation: Use high frequency mechanical vibrators to consolidate concrete and eliminate lift lines in walls exposed to view. Vibrators shall be operated by skilled mechanics under close supervision. Insert and withdraw the vibrator heads at points from 18" to 30" apart for short periods. Do not allow heads to touch the forms.

M. Leveling: Level and grade the top surface of slabs with straight edges over gauge strips. Level the top of foundations for the reception of subsequent work. Level and line steps in like manner over strips or forms. Remove wood spreaders, block, and screeds as the concrete is placed and before it sets.

N. Construction Joints: Generally, locate construction joints in beams and suspended slabs in the middle third of the span. Form each construction joint with a vertical bulkhead. Remove the bulkhead as soon as the concrete has attained its initial set and leave the surface rough. Before placing fresh concrete against the surface, coat the surface with bonding compound applied in conformance with the manufacturer's instructions.

O. Loading: Do not shake or move the forms and reinforcement nor place any strain on projecting metal after the concrete has taken its initial set. Do not permit loading or traffic of any kind on the construction until the concrete has fully hardened.

P. Hot Weather Placement: Take special care to prevent high temperatures in the fresh concrete during hot weather. Use a set-retarding type admixture to assure that concrete remains workable and lift lines will not be visible. For flatwork use a spray-on evaporation retardant as needed during finishing operations.

Q. Mechanical equipment pads required in mechanical yard shall be 6" thick with #4 @12" o.c. each way in mid-slab. Pour pad 6" larger than equipment all around. Additionally provide a continuous poured-down edge beam around the pad 18" deep by 10" wide reinforced with 2-#5 continuous in bottom of beam with #3 ties @ 24" o.c. Add intermediate beams, same size and reinforcing, if pad exceeds 12'-0" in either direction and every 12'-0" thereafter. Provide 4" thick sand bed under slab. Top of slab elevation shall be 3" above finish grade around pad.

R. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.

S. Construction (Control) Joints in Slabs-on-Grade: Construct contraction joints in slabs-on-grade with inserts ¼" wide by ¼ of slab depth. Form contraction joints by inserting premolded plastic, hardboard, or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has cured, remove inserts and clean groove of loose debris. If joint pattern is not shown, provide joints not exceeding 15' in either direction and located to conform to bay spacing wherever possible.

3.4 CORRECTING DEFECTIVE CONCRETE

A. Examine concrete for defects as the forms are removed. Concrete out of alignment or with defective surfaces shall be considered as not conforming to the intent of these specifications. Such concrete shall be removed from the project site unless the Architect grants permission to patch the defective area.

B. Concrete that does not attain the specified 28-day strength shall be removed from the project site at the contractor's expense.

C. Formed surfaces exposed to view shall not have fins, offsets, voids, and bulges. Minor grain marks will not be objectionable, but the texture shall be uniform. Leave corners and other details sharply defined and surfaces straight and true.

D. Repair honeycomb, pour joints, stone pockets, and like imperfections by wetting and pointing with mortar to match adjacent concrete. Where unacceptable surface blemishes occur on concrete exposed to view, rub the entire surface to produce a uniform appearance throughout.

3.5 FILLING TIE ROD AND BOLT HOLES

A. Fill solidly with stiff cement grout the holes in concrete resulting from the removal of bolts and rods. Strike off flush any excess mortar at the faces of the holes. In concrete exposed to view, holes shall be patched with mortar to match adjacent concrete.

3.6 CONCRETE TOPPING

A. Concrete Toppings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: 3000 psi at 28 days.
   2. Minimum Cementitious Materials Content: 540 lb/cu. yd.
   3. Slump Limits: 5 inches, plus or minus 1 inch.
   4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

B. Provide concrete topping as detailed, at minimum thickness of 2 inches. Before the topping is placed, remove loose dirt and sand particles with a stiff broom. Brush in a bonding coat of neat cement just ahead of the topping. Screed, tamp, and float the topping to the lines and slopes indicated. Finish as specified below.

C. Delay installation of concrete toppings at entrances to insure that finished surfaces will not be stained nor damaged by subsequent construction activities. Remove and re-installed stained or damaged concrete toppings at entrances as directed by Architect.

3.7 CONCRETE FLOOR, SLAB, AND TOPPING FINISHES

A. Steel Trowel: For concrete floor surfaces to be left exposed, to receive resilient tile, or carpet, provide a standard integral trowel finish. This finish is required on all concrete wearing surfaces for which other specific finishes are not indicated or scheduled.
   1. Strike the surface at the finish floor elevation, and roll and tamp the concrete to force aggregate away from the surface. Screed to a true, level surface except where slopes are specifically indicated, and float when hard enough to support knee boards.
   2. Bring the surface to a true grade by cutting down high spots and filling low spots with fresh concrete. Test with a 16 ft. straight edge, or shorter in restricted areas, and limit surface variations to not more than ¼" in 16'.
   3. Finish the floor with a steel trowel to a smooth dense surface. When hard enough to ring under the trowel, burnish the surface to the final polished finish.

B. Smooth: Concrete slab surfaces to be covered with thinset ceramic tile shall receive steel trowel finish, except that the second burnish troweling shall be omitted. Leave surfaces with some "tooth" for a bond.

C. Brush: Provide a texture finish for exterior concrete except where scheduled otherwise. After floating and an initial troweling, go over the surfaces with a soft bristle brush or broom to produce a fine textured non-slip finish. Exposed vertical surfaces and corners shall be tooled and troweled smooth.

D. Float: Concrete slabs with sloped surfaces, shall be screeded and floated to a true, relatively smooth finish without sharp projections, offsets and other irregularities.

E. Architectural Concrete Finish (cast-in-place concrete counters): Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix 1 part Portland cement to 1-1/2 parts fine sand with a 1:1 mixture of bonding admixture and water. Add Portland cement in amounts determined by trial patches so color of dry grout matches adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whites, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours. Horizontal and vertical surfaces shall be smooth and without voids, holes, depressions, and other imperfections.

3.8 CURING

A. Cure all concrete at least 7 days. All curing procedures shall prevent evaporation of moisture from the concrete for the full curing period. Protect surfaces from traffic damage until the curing is complete.

B. Keep exposed vertical surfaces and the tops of beams and walls moist by spraying with water or covering with saturated burlap, starting as soon as the surfaces will resist erosion.

C. Concrete surfaces to be covered with thinset flooring materials (ceramic tile, vinyl composition tile, etc.), shall be cured by covering with reinforced 2-ply paper or 4 mil thick polyethylene sheeting laid with joints lapped 3" and sealed with tape. Do not use curing compound on these surfaces.

D. Coat other concrete wearing surfaces with the curing and sealing compound, using at least 1 gallon per 300 sq. ft. Areas damaged by traffic or subsequent construction operations shall be re-coated.

3.9 FIELD QUALITY CONTROL

A. Acceptance Tests:
   1. Samples for strength tests of concrete shall be taken from each 75 cu. yds., or fraction thereof, of each mix design of concrete placed in any one day.
   2. Sampling procedures shall meet the requirements of ASTM C 172. If concrete is being pumped, take concrete samples for testing at the point of placement and not at the mixer discharge.
   3. Make and record a slump test on each sample. The method of test shall meet the requirements of ASTM C 143.
   4. Make 4 cylinders from each sample for strength tests, 1 for 7-day, 2 for 28-day test, and 1 in reserve. The cylinders shall be made on the project site by an Independent Testing Laboratory and shall be cured and tested in conformance with the requirements of ASTM C 31 and C 39.

5. Samples for 3-day strength tests may be taken at the Contractor's discretion and at the Contractor's expense.
6. Samples for temperature and slump tests of concrete shall be taken from each truck, of each mix design of concrete placed in any one day.
7. Testing lab representative shall be on site at all times during concrete pours.
8. No water shall be added to concrete mix on project site without approval from Owner's Testing Laboratory.
9. Concrete delivery tickets for all trucks shall be given to General Contractor for later submission to Owner. Delivery tickets shall record time truck left plant, time truck arrived at site and mix design number being delivered. A maximum of 90 minutes will be allowed from mixing of concrete to delivery.

B. Evaluation of Test Results:
1. Each strength test result shall be the average of 2 cylinders from the same sample tested at 28 days.
2. Strength of each concrete mixture will be satisfactory if the average of any 3 consecutive compressive-strength tests equals or exceeds the specified compressive strength and no individual strength test value falls below specified compressive strength by more than 500 psi.
3. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that compressive strengths or other requirements have not been met. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42. Additional testing and inspecting, at Contractor’s expense, will be performed to determine compliance of replaced or additional work.

C. The cost of testing service shall be per SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

3.10 GROUTING

A. Grout base plates and other structural members. Pea gravel may be added to the grout if the space to be grouted is 1" thick or more. Do not add sand to the grout.

3.11 BASE PLATE ANCHOR BOLTS

A. Set the anchor bolts for steel base plates. Use templates.

3.12 PATCHING

A. Patch and repair existing concrete to restore smooth, uniform surfaces.

B. Prepare the surfaces by removing loose and faulty material down to firm concrete. Edges of concrete exposed to view shall be saw-cut straight and square. Brush the surfaces free of dirt and debris and flush down with clean water. After the surfaces are dry, coat them with bonding compound used in conformance with the manufacturer's instructions.

C. Major patching and deep fills shall be done with a mixture of 1 part Portland cement, 1½ parts sand, and 1½ parts pea gravel. Work and tamp the fill into place, screed the surface and float and trowel to a smooth finish. Cure as specified above.

D. Minor patching and re-surfacing of concrete to be covered with tile and carpet shall be done using a suitable re-surfacing material such as Ardex K-15 or Super Flo-Top, which can be carried to a feather edge. Mix and apply in conformance with the manufacturer's instructions and finish to a smooth surface.

3.13 SEALING EXPOSED CONCRETE FLOORS

A. Immediately prior to completion of the building, clean exposed concrete floors to remove dirt, stains, paint, oil and grease. Coat the clean, dry surfaces with sealing compound. Application shall conform to the manufacturer's instructions. Do not allow to puddle.

3.14 PROTECTION AND CLEAN UP

A. Floor Protection: All concrete floors which will be exposed to view in the completed building shall be covered with reinforced paper with joints lapped and sealed. Maintain the protective covering until all wet work in the building (masonry, plaster, and tile) is completed.

B. Clean Up: Excess concrete and wash water from concrete truck drums shall not be dumped anywhere on the site or on adjoining streets, but shall be disposed of away from the premises.

END OF SECTION

SECTION 03 35 46

CONCRETE TOPICAL TREATMENTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work Included:
   1. Application of sealing compound to new and existing concrete floor slabs.

B. Related Work:
   1. Section 03 30 00 - Cast-In-Place Concrete

1.2 SUBMITTALS:

A. Product Data: Manufacturer's complete product information and application instructions.

B. Certificate: Manufacturer's written certification that proposed products comply with applicable Volatile Organic Compound (VOC) regulations.

1.3 QUALITY ASSURANCE:

A. Comply with Texas Natural Resources Conservation Commission *Regulation V* regarding VOC content of Architectural coatings. Architectural coatings are protective or decorative coatings applied to interior or exterior of buildings or structures, including latex paint, alkyd paints, stains, lacquers, varnishes, and urethanes.

B. Apply only when air temperature is between 40ºF and 90ºF. Allow materials to reach ambient temperature prior to application.

C. Do not apply to concrete surfaces scheduled to receive adhered floor coverings such as resilient flooring and carpet.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Deliver materials in factory packaging with tags and labels intact and legible.

B. Store in a dry, ventilated area protected from freezing.

C. Carefully handle to prevent spills. Close container after each use.

PART 2 - MATERIALS

2.1 PRODUCT/MANUFACTURER:

A. Seal Basis of Design: Provide ClariShield Water-Based Natural Look Clear Sealer that produces a clear, low -sheen, non-yellowing, slip-resistant penetrating finish as manufactured by H & C.
   1. Substitutions for Equivalent Products: Refer to SECTION 01 62 00 - PRODUCT OPTIONS for substitution request procedures.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Prepare concrete surfaces to be sealed according to manufacturer's recommendations.
   1. Remove all existing curing compounds, oil, grease, laitance, and other incompatible materials.
   2. Apply seal only to properly cleaned, etched, and thoroughly dried concrete surfaces.

B. Protect adjacent surfaces from overspray, including joint surfaces prior to installation of joint sealant.

3.2 APPLICATION:

A. At new concrete, apply after surface water glaze is gone.

B. Spray first coat uniformly at the rate of 300 sf/gal. Let first coat dry 6 to 8 hours before applying second coat. Apply second coat uniformly at the same rate in the opposite direction. Squeegee or wipe up all puddling.

C. Apply only to areas where sealed concrete floor finish is scheduled.

D. Apply two uniform coats at 300 sf per gallon each without puddling, according to manufacturer's written instructions.

3.3 CLEANING AND PROTECTION:

A. Clean up and legally dispose of all debris, containers, and other materials from flooring work. Remove from Owner's property.

B. Protect surfaces from traffic for at least 8 hours after final coat application.

END OF SECTION

SECTION 03 52 16

INSULATING CONCRETE DECKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast-in-place lightweight insulating concrete, placed over structural subbase installed by others.

B. Related Sections:
   1. Section 05 31 00 - Steel Decking: Requirements for ventilated decking.
   2. Section 06 10 00 - Rough Carpentry: Wood blocking, curbs

1.2 SUBMITTALS

A. General: Submit the following in accordance with Section 01 33 23 - Shop Drawings, Product Data, and Samples.

B. Product data
   1. Describe products and methods of mixing and application instructions.
   2. Include plans, sections, and details showing roof slopes, lightweight concrete roof insulation thicknesses, embedded board insulation, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.

C. Certificates by an independent testing laboratory stating that materials and mix intended to be used meet specified requirements.

1.3 QUALITY ASSURANCE

A. Insulating Concrete Supplier: Regularly engaged in production of lightweight insulating concrete materials.

B. Insulating Concrete Applicator: Regularly engaged and properly equipped for application of lightweight insulating concrete, and as acceptable by aggregate producer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.

B. Store packaged materials to protect them from elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.5 JOB CONDITIONS

A. Do not place lightweight insulating concrete when ambient temperature is at or below freezing (32°F).

B. When air temperature has fallen or is expected to fall below 40°F., heat water to a maximum 120°F. before mixing to attain lightweight concrete at point of placement with temperature of 50°F. min. and 80°F. max.

C. Do not place lightweight insulating concrete on surfaces covered with standing water, snow, or ice.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cellular-Type Insulating Concrete Materials.
   1. Portland Cement: ASTM C 150, Type I or Type III.
   2. Foam Concentrate: Protein-based foam concentrate conforming to ASTM C869 and ASTM C796.
   3. Curing Compound: Type recommended by manufacturer.

B. Control Joint Filler: ASTM C 612, Class 2, glass fiber type, Compressing to one-half thickness under a load of 25 psi.

C. Insulation Board: Rigid polystyrene boards or formed units with minimum density of 1 pcf complying with ASTM C 578.
   1. Keying Holes: Provide units with keying holes of approximately 3 percent of board gross surface area.
   2. Thickness: Provide units in thickness to reach R-Value per Building Envelope Roof Assembly Type on drawings.

D. Reinforcing: 3/4 inch long, polypropylene fiber, Fibermix as manufactured by Fibermesh Co. for cellular concrete only.

2.2 DESIGN MIX

A. General: Design lightweight insulating concrete mix to produce the following minimum physical properties.
   1. 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 **350** psi when tested according to ASTM C 495.
   2. Basis manufacture: Celcore Elastizell, Insucel, Mearlcrete

B. Do not exceed maximum air content recommended by aggregate manufacturer.

C. Use minimum amount of water necessary to produce a workable mix.

D. Do not use Calcium dioxide in lightweight insulating concrete fill.

PART 3 - EXECUTION

3.1 PREPARATION

A. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of insulation control joints.
   1. Provide 1-inch-wide expansion joint material for roof areas with dimensions up to 100 ft. in length; 1-1/2 inches thick for roof area dimensions exceeding 100 ft.

3.2 PLACEMENT

A. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.

B. Install insulation board according to lightweight insulating concrete manufacturer's written instructions. Place insulation board in wet, lightweight insulating concrete slurry poured a minimum of 1/8 inch over the structural substrate. Ensure full contact of insulation board with slurry. Stagger joints and tightly butt insulation boards.

C. Deposit and screed lightweight insulating concrete in continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated on drawings. Leave top surface in acceptable condition to receive subsequent roofing application.

D. Begin curing operations immediately after placement, and air cure for not less than 3 days in accordance with manufacturer's recommendations.

E. Provide temporary protection of removable waterproof covering to prevent direct exposure to moisture if roofing application is not started immediately after completion of curing.

3.3 FIELD QUALITY CONTROL

A. Engage an independent testing laboratory acceptable to Architect to take samples and conduct tests to evaluate lightweight insulating concrete. Do not use same testing service that provided initial mix designs.

B. Owner will engage an independent testing laboratory to take samples and conduct tests to evaluate lightweight insulating concrete.
   1. Take samples in accordance with ASTM C 172, except as modified by ASTM C 495.
   2. Determine wet density in accordance with ASTM C 138.
   3. Determine compressive strength and oven-dry density in accordance with ASTM C 495. Make at least 6 molds during each placement.

C. Report test results to Architect and lightweight insulating concrete producer within 24 hours of completion of each test.

3.4 DEFECTIVE WORK

A. General: Refinish or remove and replace lightweight insulating concrete surfaces that are too rough to receive finish roofing, or where physical properties do not meet specified requirements, as determined by Architect.

END OF SECTION

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SECTION 04 20 00

MASONRY UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Unit masonry construction.

B. Related Requirements:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 03 11 00 - Concrete Forming and Accessories: dovetail anchor slots.
3. Section 05 50 00 - Metal Fabrications: steel lintels.
4. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
5. Section 07 65 00 - Flexible Flashing: through-wall flashing for masonry walls.
6. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.
7. Section 07 92 00 - Joint Sealants.
8. Section 07 95 00 - Expansion Control.
9. Section 08 11 00 - Hollow Metal Doors and Frames: installation of steel frames.
10. Section 10 99 00 - Miscellaneous Specialties; Recessed Knox Box.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit for each type of product indicated.
1. Include statements of material properties indicating compliance with requirements including compliance with standards and type designations within standards.

C. Samples: Within 60 days after the contract has been awarded, submit manufacturer's standard sample panel showing full range of color, approximately 12" x 24" for each color and size of Concrete Masonry Unit required.

D. Test Reports: Manufacturer of the concrete masonry units shall submit:
1. Certified test reports showing that the units to be furnished meet the requirements of ASTM C 90 and C 129, and have the required minimum compressive strengths.
2. Reports certifying concrete masonry units meet or exceed each of the fire-resistive ratings.

E. Provide a diagram of proposed control joints and expansion joints.

F. Submit steel reinforcing shop drawings for load-bearing concrete masonry unit walls, including elevations showing reinforcing, control joints, bond beams, dimensions and details.

G. Mortar Mixture Proportions: ASTM C 270, Submit copies of each proposed mix design for review prior to starting masonry work.

H. Grout Mixture Proportions: ASTM C 476, Submit copies of each proposed mix design for review prior to grout placement.
1. Include recent historical grout cylinder strength test reports for each mix design.

I. Pre-blended Mortar and Grout Certificates: Submit manufacturer’s certificates that products meet or exceed specified requirements.
1. Mortar: Submit test reports, per ASTM C 780, for each mortar mix indicating strength of mortar mixes. Submit computer batch-ticket to confirm the mixes meet the project SPEC MIX specifications for every bag of mortar.
2. Grout: Submit test reports, per ASTM C1019, for each grout mix indicating compressive strengths. Submit computer batch-ticket to confirm the grout mixes meet the project SPEC MIX specifications for every bag of grout.

1.3 QUALITY ASSURANCE

A. Manufacturer: Manufacturer shall have a minimum of five years' experience manufacturing the specified product.

B. Installer: Masonry contractor shall have a minimum of five years' experience in similar types of work and be able to furnish a list of previous jobs and references if requested by the Architect.

C. Pre-installation Conference: Contractor shall schedule pre-installation conference at the project site with Architect/Engineer and Owner's Testing Lab. Conference shall be held prior to proceeding with masonry work and shall comply with requirements in Division 01 Section "Project Management and Coordination".

D. Expansion Joints (Control Joints): Provide expansion joints as shown on the Drawings or if not shown, install at frequency and in accordance with details as recommended by the N.C.M.A. or B.I.A. Confirm locations and frequency with Architect before beginning work. Refer to expansion joint Paragraph in the Installation portion of this specification section.

E. Mock-up: Construct a sample wall panel at the site using burnished CMU, and mortar proposed for the project. The panel shall duplicate the typical building wall construction (coursing, bonding, joint treatment, sealant, cleaning methods and materials as required in SECTION 07 92 00 - JOINT SEALANTS). Sample panel shall be fully acceptable to the Architect prior to ordering of materials. Install one vertical 3/8" control joint for full height of panel. Panel shall be not less than 6 ft. by 4 ft. Construct panel on a wood pallet, providing portability around the project site. Do not alter nor destroy mock-up until attainment of Substantial Completion. Approved mock-up panel shall be the standard of comparison for workmanship and materials.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Brick Delivery: Do not lay face brick until at least 50% of the brick for the project has been delivered. As brick work progresses, make additional deliveries of brick so that at all times at least 50% of the remaining brick requirements are on the project site. Serve masons brick intermixed from the various storage piles to assure blending of brick.

B. Store face brick and masonry units above ground on wood pallets which allow air circulation under the stacked units.

1.5 PROJECT CONDITIONS

A. Refer to "Protection" Paragraph for daily activities.

B. Cold Weather Construction: Do no masonry work when freezing weather is expected. If Contractor elects to lay masonry when air temperature falls or is expected to fall below 40°F., provide construction means and protection of completed masonry as described in BIA Technical Note 1 - Cold and Hot Weather Construction -- Construction and Protection Recommendations.
   1. The use of admixtures or antifreezes to lower the freezing point of mortar shall not be permitted.

C. In hot weather (above 99°F. with less than 50% relative humidity) protect masonry construction from direct exposure to sun and wind.

D. Temporary Bracing: Take adequate precautions to prevent damage to walls during erection by high winds or other forces. Where necessary, provide temporary bracing until the designed lateral strength is reached.

PART 2 - PRODUCTS

2.1 MASONRY MATERIALS

A. Brick Veneer: ASTM C 216 face brick or ASTM C 652 hollow brick.
   1. Face Brick: ASTM C 216, Grade SW, Type FBS, face brick.
   2. Hollow Brick: ASTM C 652, Grade SW, Class H40V, Type HBS, hollow brick with 3/4" minimum shell thickness on outer face shell, inner face shell, and end webs.
   3. Brick Veneer : Estate size face brick or hollow brick with actual dimensions of 2 ¾"D x 3 5/8"H x 9-5/8"L. Provide brick type as manufactured by Acme Brick, color as scheduled in MATERIAL FINISH SCHEDULE in drawings. Manufacturer's identification on brick will not be acceptable.

4. Substitutions: Requests for substitutions will be considered in accordance with provisions of SECTION 01 62 00 - PRODUCT OPTIONS.

B. Concrete Masonry Units: ASTM C 90, Grade N-I, moisture controlled, for load-bearing units; ASTM C 129, moisture controlled, Type I, for non-load-bearing units. Provide hollow units made from Portland cement and lightweight mineral aggregate.
   1. Color: Masonry shall have an integral color as selected by Architect.
   2. All units shall be from the same manufacturing plant and shall have the same surface texture.
   3. Provide 1" bullnose units at exposed outside corners and jambs and as noted on drawings.
      a. Provide square edge starter course corners at all rubber base conditions where preformed base corners are specified to be provided.
   4. Provide sash block control joints at concrete block walls with pre-molded rubber control joint filler.
   5. Nominal Size: 8" x 16" face.
   6. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.

C. Burnished Concrete Masonry Units : Provide Best Block burnished concrete masonry units, color as scheduled in MATERIAL FINISH SCHEDULE in drawings, 11 5/8” x 7 5/8” x 15 5/8” and 7 5/8 x 7 5/8” x 15 5/8” units. Burnished concrete masonry units shall be manufactured with Dry-Block admixture as manufactured by W.R. Grace & Co or Eucon Blocktite as manufactured by Euclid Chemical. Provide square-edge units for outside corners. All exposed edges shall match face. Equivalent products, as determined by the Architect, by Featherlite may be acceptable.
   1. Provide both burnished one face, one face and end, both faces, and both faces and end as required.

2.2 REINFORCING AND TIES

A. Wall Ties: ASTM A153
   1. For Brick Veneer at CFS: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, stainless steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in Section 07 2100 - Building Insulation. Also provide polymer-coated screws and stainless steel ties/pintles of 3/16" diameter, with pintle length as required.. Product/manufacturer; one of the following:
      213 with 282; Heckman Building Products, Inc.
      HB-213 with 2X Hook; Hohmann & Barnard, Inc.
      2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)
   2. For Brick Veneer at CMU: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, stainless steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated Tapcon screws and stainless steel ties/pintles of 3/16" diameter, with pintle length as required.. Product/manufacturer; one of the following:
      213 with 282; Heckman Building Products, Inc.
      HB-213 with 2X Hook; Hohmann & Barnard, Inc.
      2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)
   3. Wall Ties at ICF: Provide hot-dip galvanized at interior conditions and Type 304 stainless at exterior conditions. Product/manufacturer, or approved equivalent:
      Thermal Concrete 2-Seal Wing Nut Anchor w/ 2X Hook; Hohmann & Barnard, Inc.
      Contractor Option at Interior Locations Only:
      Blok-Lok ICF Masonry Anchor (through-form) with Flex-O-Lok tie; Hohmann & Barnard, Inc.
   4. For solid masonry, ties shall be 16 gage hot dip galvanized corrugated steel straps 7/8" wide x 7" long.
   5. For glazed facing tile, ties shall be 10 gage hot dip galvanized steel wire loops or 18 gage galvanized corrugated steel straps.

B. Triangular Ties and Column Anchors: ASTM A 82 hot dip galvanized steel wire, 3/16" diameter ties and 1/4" diameter anchors, for tying masonry walls to steel columns.

C. Dovetail Anchors: 16 gage hot dip galvanized corrugated steel ties 1" wide x 4 1/2" long.

D. Joint Reinforcement at Single-wythe Concrete Masonry Unit: Provide ladder type with continuous 9 gage ladder side and cross rods spaced not more than 16" o.c. and welded, unless smaller spacing is shown on the drawings. Product/manufacturer; one of the following:
      #220 Ladder-Mesh; Hohmann & Barnard, Inc.
      Series 200 Ladder Mesh; Wire-Bond
   1. Finish shall be Class 1 mill galvanized.
   2. Corners and tees shall be prefabricated.

E. Wall Ties for CMU Veneer at CMU Backup: Provide adjustable veneer anchors consisting of 14 gage, ASTM A580, stainless steel screw-on backplates and holes at top and bottom with legs in length as required to accommodate insulation thickness as shown on drawings and specified in SECTION 07 2100 - BUILDING INSULATION. Also provide polymer-coated screws and stainless steel ties/pintles of 3/16" diameter, with pintle length as required. Product/manufacturer; one of the following:
213 with 282; Heckman Building Products, Inc.
HB-213 with 2X Hook; Hohmann & Barnard, Inc.
2401 (RJ-711) with 242 Hook; Wire-Bond (Masonry Reinforcing Corp. of America)

A. Joint Reinforcement at Multi-wythe Concrete Masonry Unit: Provide ladder type with continuous 9 gage sid and cross rods spaced not more than 16" o.c. and welded, unless smaller spacing is shown on the drawings. Product/manufacturer; one of the following:
#270-2X Ladder Eye-Wire; Hohmann & Barnard, Inc.
Series 800 Ladder; Wire-Bond
1. Finish shall be hot-dip galvanized.
2. Corners and tees shall be prefabricated.

B. Joint Reinforcement for Masonry Veneer Not Laid in Running Bond: Provide ASTM A580, single 9 gage diameter (W1.7) AISI Type 304 stainless steel continuous wire with rigid polyvinyl chloride seismic clip connector attached to masonry veneer wall tie/pintle. Provide seismic clip connector as manufactured by the following manufacturer or approved equivalent:
“Seismiclip Interlock System” #187; Hohmann & Barnard, Inc.

C. Reinforcing Steel: ASTM A 615, Grade 60, deformed billet steel.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, domestic manufacture.
1. Provide white Portland cement for colored mortar.
2. Provide natural Portland cement for other masonry.

B. Lime: ASTM C 207, Type S, with not more than 8% unhydrated oxides.

C. Aggregate for Mortar; Sand: ASTM C 144, well-graded natural sand. Provide white or light color sand for colored mortar and white mortar.

D. Aggregate for Grout: ASTM C 404.

E. Coloring Pigment: Standard mortar color(s) as selected by Architect**.** Provide coloring pigment as manufactured by Lambert Southwest, Inc., (phone 903.657.4680 web site: www.lambertsw.com) or Solomon Colors (phone 800.624.0261 web site www.solomoncolors.com).

F. Water: Clean and free of deleterious amounts of acids, alkalis, or organic materials.

G. Water-repellent Admixture: Provide same integral liquid polymeric water repellent admixture used in split-faced and burnished concrete masonry units for mortar used in laying split-faced and burnished concrete masonry units.

2.4 MORTAR - FIELD PREPARED

A. Mix proportions: ASTM C 270, mortar proportions by volume:
1. Type N Mortar - Exterior and Interior at masonry veneer construction:
1 part Portland cement
1 part lime
6 parts sand
Coloring Pigment: Add coloring pigment at manufacturer's recommended rate to obtain blended colors as selected by Architect. No mortar color is required at concealed or painted masonry.
2. Type M Mortar - Exterior masonry veneer construction below grade or in contact with earth:
1 part Portland cement
1/4 part lime
3-3/4 parts sand
3. Type S Mortar - Exterior and Interior at load-bearing and non-load-bearing concrete masonry unit walls:
1 part Portland cement
1/2 part lime

4-1/2 parts sand

Coloring Pigment: Add coloring pigment at manufacturer's recommended rate to obtain blended colors as selected by Architect. No mortar color is required at concealed or painted masonry.

4. Bedding Mortar:
   1 part Portland cement
   1/7 part lime
   3 parts sand

B. Mixing:
   1. All dry material shall be accurately measured in a leak-proof batching box. Contractor shall have the option of using a pre-manufactured cubic foot batching box or fabricating a wood box for measuring dry materials by volume. Box may be a convenient size, but shall be not less than 12" x 12" x 12" inside dimensions. The use of shovels for measuring dry materials is strictly prohibited.
   2. Proportion mortar accurately and mix thoroughly with the maximum amount of water to produce a workable consistency for at least 5 minutes in a mechanical batch mixer. Keep tools and mixing equipment clean.
   3. Do not use mortar which has begun to set, or if more than 2½ hours have elapsed since initial mixing. Do not re-temper mortar.
   4. Mortar for Split-face, Smooth-face, and Burnished Concrete Masonry Units: Add water repellent admixture at manufacturer's recommended rates to ensure mortar will be permanently water repellent.

C. Use: Lay exterior and interior masonry veneer construction using Type N mortar. Lay exterior masonry veneer below grade or in contact with earth using Type M mortar. Lay exterior and interior load-bearing masonry using Type S mortar. Where required use bedding mortar to set and fill hollow metal frames.

D. Masonry cement is not acceptable for mortar.

E. Do not use calcium chloride in mortar.

F. Pre-mix, dry or wet, is not acceptable for mortar, except as listed below; i.e. no other pre-mix mortars are acceptable.

2.5 MORTAR; PRE-BLENDED MORTAR MIXES, COLORED MORTAR MIXES, AND INTEGRAL WATER REPELLENT MORTAR MIXES

A. Contractor's Option: Provide pre-blended mortar mix, colored mortar mix, and integral water repellent mortar mix as manufactured by SPEC MIX, Inc. (phone 888.773.2649 web site: www.specmix.com), instead of field-prepared mortars. SPEC MIX pre-blended mortar option shall include manufacturer's standard silo system for mixing and delivery of mortar mixes.
   1. Equivalent products by Quikrete Cement and Concrete Products–Dallas (800.627.6125) will be considered acceptable.
   2. Pre-blended mortar mixes shall be mixed with potable water in strict compliance with manufacturer's written instructions and recommendations.
   3. Masonry cement is not acceptable for pre-blended mortar.

B. SPEC MIX PCL Sand Pre-blended Mortar Mix:
   1. Material: Pre-blended factory mix of Portland cement, hydrated lime and sand aggregate mixtures.
   2. Mortar Type: Property mixture Type S for exterior and Interior at load-bearing and non-load-bearing masonry unit walls and Type N for exterior and Interior masonry veneer construction.

C. SPEC MIX PCL Sand Pre-blended Colored Mortar Mix:
   1. Material: Pre-blended factory mix of Portland cement, hydrated lime, sand aggregate, and color pigments.
   2. Mortar Type: Property mixture Type S for exterior and Interior at load-bearing and non-load-bearing masonry unit walls and Type N for exterior and Interior masonry veneer construction.

D. SPEC MIX PCL Sand Pre-blended IWR Colored Mortar Mix:
   1. Material: Pre-blended factory mix of Portland cement, hydrated lime, sand aggregate, color pigments, and incorporating dry SPEC MIX Integral Water-repellent Mortar Admixture.
   2. Mortar Type: Property mixture Type S for exterior and Interior at load-bearing and non-load-bearing masonry unit walls and Type N for exterior and Interior masonry veneer construction.

E. Mixing: Mix mortar using manufacturer's standard mechanical mixer to ensure homogeneity and workability. Observe mixing times of 4-5 minutes, consistent from batch to batch. Use clean, potable water; add the maximum amount consistent with optimum workability.

1. At the end of the day, thoroughly rinse the mixer to avoid contamination of future mortar batches.
2. Discard mortar 2.5 hours after initial mixing.

2.6 GROUT; FIELD PREPARED

A. Grout shall conform to ASTM C 476. Provide grout for bond beams, masonry lintels, and reinforced masonry.
   1. Fine Grout Proportions:
      1 part Portland cement
      1/10 part lime
      3 parts fine aggregate
   2. Coarse Grout Proportions
      1 part Portland cement
      1/10 part lime
      3 parts fine aggregate
      2 parts coarse aggregate

B. When placing grout in masonry, exercise extreme care to prevent grout from staining face of masonry.

2.7 MASONRY CLEANER

A. Use "Sure-Klean Vana Trol" as manufactured by ProSoCo, Inc., or an approved equivalent inorganic commercial masonry surface cleaner. "Sure Klean 600" may be used at concrete masonry units which are not adjacent to colored mortar and concrete masonry units which are scheduled to be painted.

2.8 ACCESSORIES

A. Control Joints: Preformed rubber material; RS Series Rubber Control Joint as manufactured by Hohmann & Barnard, Inc. or comparable products by Heckman. Width slightly less than wall thickness to allow for sealant material.

A. Cellular Plastic Weeps:
   1. One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8" less than depth of outer wythe.
   2. Color shall be selected by Architect from full range of color samples.
   3. Product/manufacturer; one of the following:
      Mortar Maze weep vent; Advanced Building Products Inc.
      No. 85 Cell Vent; Heckmann Building Products Inc.
      Quadro-Vent; Hohmann & Barnard, Inc.
      Cell Vent; Wire-Bond

B. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the cavity. Provide strips, full-depth of cavity, 10 inches high, with dovetail shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings. Product/manufacturer; Mortar Net™ with Insect Barrier, Mortar Net USA, Ltd. (phone 800.664.6638 web site: www.mortarnet.com).
   1. 0.4” thick Mortar Net between back of brick and steel lintels, cut down to required height.
   2. Provide single thickness 2” material at 1-3/4” to 2-1/4” wide masonry cavities.

C. Provide “BlockFlash” as manufactured by Mortar Net USA, Ltd. CMU cell flashing pans with built-in adjoining bridge made from recycled polypropylene with chemical stabilizers that prevent UV degradation. Flashing pans have a sloped design to direct moisture to the integrated weep spout. Designed to be built into mortar bed joints to expel moisture (unimpeded by mortar droppings) to the exterior of CMU walls.

D. Rebar Positioners: Size and type required to accurately place reinforcing steel in bond beams, concrete masonry unit lintels, and vertically in walls.

PART 3 - EXECUTION

3.1 PREPARATION

A. Cleaning: Beams, slabs, and lintels on which masonry walls and partitions are to be laid shall be brushed thoroughly to remove loose dirt and laitance.

3.2 INSTALLATION

A. Installation Tolerances:
   1. Maximum Variation from Plumb:
      a. Vertical lines and surfaces of columns and walls:
         1) 1/4" in 10'-0".
         2) 3/8" in any story or 20'-0" maximum.
         3) 1/2" in 40'-0".
      b. External Corners or Control Joints:
         1) 1/4" in any one story or 20'-0" maximum.
         2) 1/2" in 40'-0".
   2. Maximum Variation from Unit to Adjacent Unit: 1/32" maximum. Maximum variation is mandatory on walls where only one surface is exposed. Where two surfaces are exposed to view, the more prominent face, per Architect, is to have maximum variation maintained, with the less prominent face allowed to exceed the maximum tolerance.
   3. Maximum Variation from Level or Grades for Exposed Lintels, Sill, Parapets, or Horizontal Grooves:
      a. 1/4" in any bay or 20'-0" maximum.
      b. 1/2" in 40'-0".
   4. Maximum Variation from Plan Location or Linear Building Line or Related Portions of Columns, Walls, and Partitions:
      a. 1/2" in any bay or 20'-0" maximum.
      b. 3/4" in 40'-0".
   5. Maximum Variation in Cross-sectional Dimension of Columns and Thickness of Walls: ±1/4.
   6. Maximum Variation in Mortar Joint Thickness:
      a. Bed Joint: ±1/8".
      b. Head Joint: ±1/8".

B. Dimensions are based on **modular** units except for special details. If units other than **modular** units are used, there shall be no change in vertical dimensions or other main dimensions of partition centerlines, and connecting work shall be adjusted to changes in unit sizes.

C. Laying Concrete Masonry Units: Spread mortar beds smooth and full to cover bearing areas. Do not furrow. Butter head joints and shove units into place. Head joints shall be staggered except where stack bond is specifically indicated. Make back joints full against the backing materials as each course is laid.
   1. Leave pipe spaces open on one full side until pipe work has been completed and inspected.
   2. Lay concrete masonry walls and partitions level, plumb, straight, and true to line within tolerances specified above.
   3. Fill the cells of exposed concrete masonry units with grout for a width of 8" at the jambs of openings in exterior walls.
   4. Exposed ends of units at external corners shall be solid.
   5. Units shown to be laid in stack bond shall be laid with such accuracy that a plumb line centered on a vertical joint in an upper course will be entirely within the width of the corresponding vertical joint in every lower course.
   6. Unless shown otherwise, provide vertical control joints every 40'.
   7. Maximum pour of grout in vertical cells shall be limited to 5'-0" unless cleanouts are provided at each cell.

D. Installation of Reinforced Unit Masonry:
   1. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.
      a. Construct formwork to conform to shape, line, and dimensions shown. make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
      b. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.
   2. Set reinforcing in required position and secure against displacement before grouting is started. Cells requiring vertical reinforcement and grout shall be aligned to provide continuous unobstructed vertical opening. Place vertical reinforcing in cells with enough steel extending to provide proper lap splice. Horizontal steel shall be fully embedded in grout.
   3. Grouting: Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure.
      a. do not exceed the following pour heights for fine grout.
         1) For minimum widths of the grout spaces of 3/4 inch or for minimum grout space of hollow unit cells of 1-1/2 by 2 inches, pour height of 12 inches.
         2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 60 inches.

3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 12 feet.
4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 2 by 3 inches, pour height of 24 feet.

b. Do not exceed the following pour heights for coarse grout.
1) For minimum widths of the grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
2) For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.
3) For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet.
4) For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.

4. Provide cleanout holes at least 3 inches in least dimension for grout pours over 60 inches in height. Cleanouts shall be sealed after inspections before grouting.
a. Provide cleanout holes at each vertical reinforcing bar.
5. Place grout in lifts not exceeding 5 feet.
6. Consolidate grout at the time of initial placement.
7. Grouting of a section of wall shall be completed within one day with no interruptions greater than one hour.

E. Reinforcing Masonry Joints: Reinforce the bed joints of concrete masonry unit walls and partitions with continuous joint reinforcement strips.
1. Furnish strips in long lengths. Width of strips shall be 2" less than nominal overall width of the wall or partition.
2. Lap strip ends 12" and bed side rods in mortar for complete cover and bond.
3. Install strips in bed joints spaced 16" o.c. for exterior walls and 24" o.c. for interior partitions, unless a smaller spacing is shown in the drawings. Reinforcement shall extend into and bond the facing wythe in walls.
4. At exterior masonry walls, discontinue horizontal joint reinforcement across control joints.
5. At interior masonry walls and intersection of interior/exterior masonry walls, continue horizontal joint reinforcement across control joints.

F. Bonding: Tie together masonry unit construction within walls and at intersections of walls by masonry bond and staggered vertical joints. Toothing will not be permitted except where specifically authorized by the Architect. Where walls must be built in advance of adjacent walls, form the stop-off by racking back.
1. Lay brick facing wythe in standard running bond with staggered head joints except where special coursing is indicated. Tie multiple wythe construction together with horizontal joint reinforcement and tab ties.
2. Where bond with joint reinforcement cannot be made, use wall ties spaced not more than 16" o.c. horizontally and vertically. Ties shall be laid in the joints, not shoved into wet mortar after setting the next course of masonry.
3. Tie brick veneer back to steel stud curtain walls and concrete unit masonry with metal ties spaced 16" o.c. horizontally and 16" o.c. vertically. Around the perimeter of openings, edges, and tops and bottoms of walls, additional ties/anchors shall be installed at a maximum of 3 ft. o.c. within 12" of the opening. Secure ties through the sheathing to the studs with two screws and insert ties.
a. Secure wall tie backplates with fasteners that are wet-set with sealant compatible with the air- and water-resistive barrier system. After installation, apply sealant along top edge of backplate to shed water.
4. Tie masonry to structural steel columns by welding anchors to columns at 16" o.c. and inserting triangular ties. Ties shall be of the size required to extend a minimum of 1-1/2” into brick veneer, with a minimum mortar cover of 5/8” to the outside face of the veneer.
5. Where concrete is faced more than 12" high with masonry, bond masonry to concrete with anchors set into dovetail anchor slots cast into the concrete. Provide the anchors. Spacing shall be as specified above for wall ties.
6. Bond interior masonry walls and the intersection of interior/exterior masonry walls by forming control joints and reinforce with horizontal reinforcing at 16" o.c.
7. Partitions between rooms without suspended ceilings, and 4" thick partitions with an unsupported length of more than 12 ft. shall be extended to the floor or roof above and wedged and sealed against it. Extend other partitions above the highest adjacent ceiling, unless indicated to extend up to floor or roof above.

G. Joints shall be 3/8" wide. Joints shall be straight and uniform.
1. Tool and work exposed joints to a hard, dense surface with a sled runner and leave without shrinkage cracks. Delay tooling until the mortar has set thumbprint hard.
2. Rake out the joints to be caulked and keep them free of mortar as the work progresses.

H. Masonry Bearings: Provide bearings of common brick under framing members which bear on masonry walls unless the members bear directly on concrete-filled bond beams.

I. Lintels and Beams: Provide lintels and beams for openings in masonry walls. This includes lintels at masonry openings for ducts. Verify duct layouts on the mechanical drawings.
   1. Reinforced Masonry Lintels: Construct and reinforce masonry lintels where shown.
      a. Make concrete masonry lintel units of the same material and by the same process as the other concrete masonry units used in the building.
      b. Use trough-type units, not regular units with the web knocked out. Fill the troughs with grout.
      c. Build lintels in place where possible and cure at least 14 days before subjecting them to load. Provide at least 8" bearing at each jamb.
      d. Where reinforcing is not specifically called out for masonry lintels, use not less than a #4 bar top and bottom of 8" high masonry units for each 4" thickness of wall.
   2. Bond Beams: Provide bond beams in masonry walls. Bond beams shall be continuous where possible. Provide rebar positioners to accurately position reinforcing steel.

J. Flashing:
   1. Build in flashings which enter the masonry, using the materials and following the instructions of the pertinent sections of the specifications.

K. Weeps: Install weep holes in veneer at 24" o.c. **[20" o.c. (king-size brick)]** horizontally for clay masonry and 32" o.c. for 16" long concrete masonry, above through-wall flashing, above shelf angles, and at top and bottom of walls. Install plastic weeps in strict accordance with manufacturer's written instructions and recommendations.

L. Cavity Drainage Material: Install cavity drainage material in cavities to comply with manufacturer's written instructions and recommendations. Provide single thickness 2" material at 1-3/4" to 2" wide masonry cavities. Provide one or more thicknesses as required to fill cavity width at other conditions. Install cavity drainage material with fabric facing to the exterior of the wall.
   1. Expansion Joints (Control Joints):
   2. At exterior masonry walls, discontinue horizontal joint reinforcement across control joints.
   3. At interior masonry walls and intersection of interior/exterior masonry walls, continue horizontal joint reinforcement across control joints.
   4. Provide resilient continuous lengths of control joint material in concrete masonry unit sash blocks. Solvent weld butt and corner joints, in accordance with manufacturer's instructions.
   5. Size control joints in accordance with SECTION 07 92 00 - JOINT SEALANTS, for sealant performance, but in no case larger than adjacent mortar joints in exposed face brick.
   6. Reference SECTION 07 95 00 - EXPANSION CONTROL for Preformed, Foam Joint Seals PJS-1.
   7. Interior control joints are not required to align with exterior control joints.
   8. Provide vertical expansion joints in masonry (concrete masonry unit), as follows:
      a. Where shown on drawings.
      b. Horizontal expanse:
         1) Concrete Masonry Units: Not to exceed a length to height ratio of 1-1/2 : 1 or 25 ft., whichever is less.
      c. Within 2'-0" of inside corners.
      d. As recommended by referenced standards.
   9. Control joints shall extend continuous through bond beam although concrete and reinforcement for bond beam shall extend continuous through control joint.

M. Built-in Work:
   1. As work progresses, build-in metal door frames, fabricated metal frames, window frames, wood nailing strips, anchor bolts, plates, and other items to be built in the work supplied by other sections.
   2. Build-in items plumb and level.
   3. Bed anchors of metal door and glazed frames in mortar joints. Fill frame voids solid with mortar. Fill masonry cores with mortar minimum 8" from framed openings.
   4. Do not build-in organic materials subject to deterioration.

N. Cutting and Fitting:
   1. Cut and fit for chases, pipes, conduit, sleeves, and grounds. Cooperate with other sections of work to provide correct size, shape, and location.
   2. Obtain approval prior to cutting or fitting an area not indicated or where appearance or strength of masonry work may be impaired.

O. Miscellaneous Work:

1. Cooperate with other trades in installing their work in masonry. Furnish bedding mortar and set loose lintels. Cooperate in setting bucks and frames, maintain them in position and build them in with anchors properly placed. Do not distort frames by crowding.
2. Cut and form openings for recessed items and for electrical and plumbing installations so that wall plates and escutcheons will completely cover the openings. Cut edges shall be clean, sharp and straight.
3. Fill solid with mortar the spaces around and behind metal door frames.
4. Point with mortar the openings around flush-mounted electrical outlet boxes.

P. Curing: In dry weather, masonry exposed to wind and sun shall be wet with a fine water spray several times each day for at least 6 days, starting as soon as the mortar has set sufficiently to resist erosion.

Q. Non-load-bearing Concrete Masonry Unit Partitions: Partitions which extend up to structure above for fire, acoustical, or security reasons, shall terminate within 2" of structural deck, joists or beams to allow for deflection. Fill 2" gap with sealant and fire safing to achieve proper rating.

3.3 PROTECTION

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Maintain protective boards at exposed external corners which may be damaged by construction activities.

C. Provide protection without damaging completed work.

D. At the end of each day's work, cover the tops of masonry walls, window sills and jambs, door jambs, and other unfinished exposed cavity wall opening with plastic sheeting or other suitable material. Cover shall extend a minimum of 2' down both sides of walls and shall be held securely in place with Hohmann & Barnard, Inc. Masonry Wall Clamp No. HB3000.

E. Keep expansion joint voids clear of mortar.

3.4 POINT AND CLEAN

A. Pointing: Upon completion of the masonry work, fill and neatly point line nail holes and other defects. Remove mortar droppings from projecting surfaces.

B. Cleaning:
1. Clean masonry with a commercial cleaner. Test the cleaner on an inconspicuous area of masonry to insure that it performs as intended without leaving scum or residue. Before the solution is applied, soak the masonry surface with clean water. Apply the cleaner in accordance with the manufacturer's instructions and rinse the surface thoroughly with clean water to remove traces of the cleaner. Protect metal and concrete surfaces from contact with the cleaner.
2. Clean exposed concrete masonry units by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings.

3.5 FIELD QUALITY CONTROL

A. General: Owner will employ services of an independent materials testing laboratory to perform specified inspections and testing.

B. Coordinate with Owner’s testing laboratory to provide PERIODIC inspection of the following tasks:
1. As masonry construction begins, and every 5000 sq. ft. during construction, the following shall be verified to ensure compliance:
   a. Proportions of site prepared mortar.
   b. Construction of mortar joints.
   c. Location of reinforcement and connectors.
2. During construction, the inspection program shall verify:
   a. Size and location of structural elements.
   b. Type, size, and location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction.
   c. Specified size, grade, and type of reinforcement and anchor bolts.

d. Protection of masonry during cold weather (temperature below 40°F.) or hot weather (temperature above 90°F.).

3. Prior to grouting at interior non-load-bearing partitions shown in the Architectural drawings, the following shall be periodically verified to ensure compliance:
   a. Grout space is clean.
   b. Placement of reinforcement and connectors.
   c. Proportions of site-prepared grout.
   d. Construction of mortar joints.

C. Coordinate with Owner's testing laboratory to provide CONTINUOUS inspection of the following tasks:
   1. Prior to grouting at masonry walls shown on the Structural Drawings, the following shall be continuously verified to ensure compliance:
      a. Grout space is clean.
      b. Placement of reinforcement and connectors.
      c. Proportions of site-prepared grout.
      d. Construction of mortar joints.
      e. Grout placement shall be verified to ensure compliance with code and construction document provisions.

END OF SECTION

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SECTION 04 43 00

STONE MASONRY VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Stone Masonry Veneer anchored to unit masonry back-up at exterior walls.
2. Stone Masonry Veneer anchored to cold-formed metal framing and sheathing at exterior walls.
3. Metal anchors, mortar, and joint pointing.

B. Related Sections:
1. Section 04 20 00 - Masonry Units.
2. Section 04 72 00 - Cast Stone Masonry.
3. Section 05 50 00 - Metal Fabrications: Shelf angles and supports.
4. Section 06 10 00 - Rough Carpentry: Wood framed supporting wall.
5. Section 07 62 00 - Sheet Metal Flashing and Trim: Coping and sill flashings.
6. Section 07 92 00 - Joint Sealers: Sealant for perimeter, and control joints.

C. Work Installed but Furnished under Other Sections:
1. Section 05 50 00 - Metal Fabrications: Metal fabricated items for building into the work.

1.2 SUBMITTALS

A. General: Submit shop drawings and product data under provisions of Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:
1. Indicate on shop drawings, layout, pertinent dimensions, anchorages, reinforcement, head, jamb, and sill opening details, and control jointing methods.
2. Submit manufacturer's field erection or setting drawings under provisions of Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
3. Submit Setting Drawings:
a. The stone supplier shall prepare and submit to the Architect, for approval, complete chopping and setting drawings for all the limestone work under this contract. Such drawings shall show in detail the sizes, sections and dimensions of stone, the arrangement of joints and bonding, anchoring and other necessary details. If the contract drawings do not show the intent of the jointing, it will be the stone fabricator’s responsibility to establish the jointing in accordance with industry standards. The contractor shall furnish all field dimensions necessary for fabrication. These drawings shall be based upon and follow the drawings and full-size details prepared by the Architect except where it is agreed in writing that changes be made. Each stone indicated on these drawings shall bear the corresponding number marked on an unexposed surface with a non-staining paint.
b. Projecting courses shall have beds in the wall at least 1” greater in depth than the projection, or be specially anchored to the structure as shown on setting drawings.
c. Provision for the proper anchoring, dowelling, and cramping of work in keeping with standard practices, also for the support of stone by shelf angles and loose steel, etc. when required, shall be clearly indicated on the setting drawings.

C. Product Data:
1. Provide product data on stone units, mortar products, and reinforcements.
2. Submit manufacturer's installation instructions under provisions of Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

D. Samples: Submit three samples 12 x 12 inch in size illustrating minimum, average, and maximum sizes, color range and texture, markings, surface finish.

E. Mockup: Before installing stone masonry veneer, construct sample wall panels 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 locations indicated or, if not indicated, as directed by Architect.
   2. Build mockups in sizes approximately 48 inches long by 48 inches high by full thickness, including chopped stone, structural supporting wall, anchors, control joint condition, and include cast stone coping at top of mockup.
   3. Notify Architect 7 days in advance of the dates and times when mockups will be constructed.
   4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a. Approval of mockups does not constitute approval of deviations from Contract Documents contained in mockups, unless such deviations are specifically approved by Architect in writing.
      b. When directed, demolish and remove mockups from Project site.
   5. Provide mockup under provisions of SECTION 01 45 00 - QUALITY CONTROL.

1.3 QUALITY ASSURANCE

A. Stone Supplier: Company specializing in quarrying chopped stone with minimum of ten years documented experience.

B. Installer: Company specializing in installing chopped stone with 5 years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.

B. Store and protect products under provisions of Section 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

C. Protect stone from visible discoloration.

1.5 PROJECT CONDITIONS

A. Maintain materials and surrounding air to a minimum 40 degrees F prior to, during, and 48 hours after completion of work.

B. During temporary storage on site, at the end of working day, or during rainy weather, cover stone work exposed to weather with non-staining waterproof coverings, securely anchored.

C. Stain Prevention: Immediately remove grout, mortar, and soil to prevent them from staining the face of stone masonry veneer.
   1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the 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 on completed stone masonry veneer.

D. Hot-Weather Requirements: Protect stone masonry-veneer work when temperature and humidity conditions produce excessive evaporation of water from mortar. Provide artificial shade and wind breaks and use cooled materials as required. Do not apply mortar to substrates with temperatures of 100 deg F and above.

PART 2 - PRODUCTS

2.1 STONE

A. Stone Masonry Veneer: RockCast Architectural Stone Masonry Veneer as produced by Reading Rock.
   1. Honed face: See MATERIAL FINISH SCHEDULE in drawings.
      a. Provide smooth back face.
      b. Provide tops, bottoms, and ends in finish to match honed face.
   2. Chiseled faced: See MATERIAL FINISH SCHEDULE in drawings.
      a. Provide smooth back face.

b. Provide corner pieces for a continuous rock faced corner.

3. Color: See MATERIAL FINISH SCHEDULE in drawings.

B. Alternate manufacturer: Upchurch Kimbrough

C. Grade: free of defects.

2.2 MORTAR

A. Mortar: ASTM C270 Type N using proportion specifications; with Type I Portland cement of custom blended color selected by Architect.

B. Water: Clean and potable.

2.3 ACCESSORIES

A. Anchors, Dowels, Ties, Cramps: Stainless Steel Wire: ASTM A580, Type 304, of size and configurations required for support of stone and applicable superimposed loads.

1. Anchors shall be of sufficient size to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face

B. Supports: Steel, ASTM A36, galvanized after fabrication to ASTM A123, 1.25 oz/sq ft.

C. Bolts, Washers, and Nuts: Galvanized steel.

D. Flashings: Furnished under SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM.

E. Sealant: Type specified in SECTION 07 92 00 - JOINT SEALANTS, not detrimental to stone work.

F. Cleaning Solution: Type which will not harm stone, joint materials, or adjacent surfaces. Consult stone supplier for recommended type.

2.4 MORTAR MIX

A. Thoroughly mix mortar ingredients in quantities needed for immediate use.

B. Add mortar color in accordance with manufacturer's instructions. Ensure uniformity of mix and coloration.

C. Do not use anti-freeze compounds in mortar.

D. Use mortar within two hours after mixing.

E. If necessary, retemper mortar within two hours of mixing to replace water lost by evaporation.

2.5 STONE FABRICATION

A. Slope exposed top surfaces of stone and horizontal sill surfaces for natural wash.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to receive stone masonry veneer, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry veneer.
   1. Examine substrate to verify that inserts, reinforcement, veneer ties, flashing, and other items installed in unit masonry and required for or extending into stone masonry veneer are correctly installed.
   2. Examine wall framing, exterior sheathing, and asphalt-saturated felt covering to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.
   3. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that support work and site conditions are ready to receive work of this Section.

C. Establish lines, levels, and coursing. Protect from disturbance.

D. Beginning of installation means acceptance of existing conditions.

3.2 PREPARATION

A. Verify that items built-in under other Sections are properly located and sized.

B. Clean stone prior to erection. Do not use wire brushes or implements which will mark or damage exposed surfaces.

3.3 INSTALLATION

A. Back Checking & Fitting to Structural Frame:
   1. Stone coming in contact with structural work shall be back checked as indicated on the general drawings. Stone resting on structural work shall have beds shaped to fit the supports.
   2. Where stone facing adjoins columns and spandrel beams the depth of stone shall be such that will allow not less than 1” of clearance between the stone and structural members.

B. Erect stone in accordance with stone supplier's instructions and erection drawings.

C. Arrange stone pattern in Random (un-coursed) Pattern, and to provide a consistent joint width of 1/4 inch throughout.

D. Set stone in full mortar setting bed to support stone over full bearing surface and to establish joint dimensions.

E. Set stone to comply with requirements indicated on Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure stone masonry veneer in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

F. Maintain uniform joint widths, except for variations due to stone size variations and minor variations required to maintain bond alignment, if any. Lay walls with joint width of 1/4 to 3/8 inch

G. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
   1. Sealing expansion and other joints is specified in SECTION 07 92 00 - JOINTS SEALANTS.
   2. Keep expansion joints free of mortar and other rigid materials.

H. Shore up units for 7 days after setting.

I. Install sealant and backing rod at joints.

J. Install flashings of longest practical length and seal watertight to back-up. Lap end joint minimum 6 inches and seal watertight.

3.4 TOLERANCES

A. Positioning of Elements: Maximum 1/4 inch from true position.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 feet; 1/2 inch in 50 feet.

C. Maximum Variation from Plumb: 1/4 inch per story non- cumulative; 1/2 inch in any two stories.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 feet; 1/4 inch in 10 feet; 1/2 inch maximum.

E. Maximum Variation of Joint Thickness: 1/8 inch in 3 feet.

3.5 CUTTING AND FITTING

A. Obtain approval prior to cutting or fitting any item not so indicated on Drawings.

B. Do not impair appearance or strength of stone work by cutting.

3.6 CLEANING

A. Remove excess mortar and sealant upon completion of work.

B. Clean soiled surfaces with cleaning solution.

C. Use non-metallic tools in cleaning operations.

END OF SECTION

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SECTION 04 72 00

CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Labor, materials and equipment to provide the cast stone as indicated on the drawings and specified herein.
2. The manufacturer shall furnish and deliver all cast stone covered by this specification.
3. Contractor shall unload, store and set all cast stone covered by this specification and shall provide and install all anchors for same.

B. Related Sections:
1. Section 04 20 00 - Masonry Units.
2. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples:
1. Initial Selection:
a. Submit samples for color selection by Architect.
b. Submit samples for colored mortar, showing the full range of colors available.
2. Following color selection by Architect, re-submit 3 samples approximately 8" x 8", finished to show the variation in color and texture which will occur in the material delivered to the project site.

C. Product data:
1. Provide construction details, material descriptions, dimensions of individual components and profiles, and finishes for cast stone units.
2. Test results of cast stone stone previously made by the manufacturer.
3. Qualification Data: Provide lists of completed projects with project names and addresses, names and address of architects and owners, and other information necessary.

D. Shop Drawings:
1. Drawings shall show the sizes, profiles, cross-sections, and dimensions of stone, the arrangement of joints, bonding, connections to adjoining walls or materials, anchoring methods, anchors, reinforcing, method of installation and anchoring.
2. Provide suitable wash on all exterior sills, copings, projecting courses and pieces with exposed top surfaces.
3. Window sills, when provided, shall have raised fillets at the back.
4. All projecting pieces and soffit stones shall have drips under the outer edge.
5. The shop drawings shall show the setting mark of each stone and its location on the structure. The stone when delivered shall bear the same corresponding setting mark on an unexposed surface.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Firm with not less than five years of continuous operation, having successful experience, adequate facilities, and capacity to furnish the quality, sizes, and quantity of cast stone required without delaying the progress of work.
2. Manufacturer shall be responsible for reinforcement and anchorage design.
3. Firm shall be a current producer member of the Cast Stone Institute.

B. The average water absorption of cast stone shall not exceed 6% by dry weight when tested in accordance with the requirements of ASTM C 642 or ASTM C 1195.

1.4 DELIVERY, STORAGE, AND HANDLING

A. All cast stone shall be carefully loaded and packed for transportation exercising customary and reasonable precaution against damage while in transit.

B. All cast stone shall be received and unloaded at the project site by competent workmen with the necessary care and handling to avoid damage and soiling.

C. Cast stone units delivered to the site shall be inspected for damage, unloaded, and stored with a minimum of handling. Damaged stone will be rejected and shall be removed from the project site.

D. Protect cast stone during storage and construction against wetting, soiling, staining, and damage.

E. The cast stone material shall be stored clear of the ground on non-staining planking or pallets in such a manner as to be protected from damage while in storage. Should cast stone be stored for an extended period, cover with polyethylene or other non-staining waterproof material.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: No stone shall be set when freezing weather is expected.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide cast stone units as manufactured by one of the following:
Advanced Architectural Stone; Fort Worth, Texas
CSCS/Stone Legends; Dallas, Texas
Dallas Cast Stone, Inc.; Dallas, Texas

2.2 CAST STONE MATERIALS

A. Raw Materials:
1. Portland Cement: ASTM C 150, Type I or Type III, white, domestic manufacture.
2. Fine Aggregate: Carefully graded and washed natural sands, or manufactured granite, quartz or limestone sands meeting ASTM C 33 except that gradation may vary to achieve desired finish and texture.
3. Coarse Aggregate: Carefully graded and washed natural gravels, or crushed, graded stone such as granite, quartz, limestone or other durable stone meeting ASTM C 33 except that gradation may vary to achieve desired finish and texture.
4. Color and Finish:
   a. Color shall be as scheduled on MATERIAL FINISH SCHEDULE in drawings.
   b. Coloring Agent: Inorganic (natural or synthetic) iron oxide pigments complying with ASTM C 979, excluding the use of a cement grade of carbon black pigment, and shall be guaranteed by the pigment manufacturer to be non-fading and limeproof. The amount of pigment shall not exceed 10% by weight of the cement used.
   c. The samples shall be approved by the Architect before the manufacturer shall be permitted to proceed with the work.
   d. Match sample on file in Architect's office. Color and texture of cast stone shall be generally equal to the approved sample when viewed in direct daylight at a 10-foot distance.
   e. Exposed surfaces, unless shown otherwise, shall exhibit a fine grained texture similar to natural stone. No bug holes or air voids will be permitted.
   f. Variation: Must match color and finish of approved sample subjected to similar aging and weathering conditions when viewed in direct daylight at a 10 foot distance.
5. Admixtures - ASTM C 494.
6. Water: Clean, potable and free of deleterious amounts of acids, alkalies, or organic materials.

B. Physical Properties:
1. Cast stone shall have a minimum compressive strength of 6,500 psi at 28 days when tested in accordance with ASTM C 1194.
2. Multiply requirements of field cut or core drilled specimens by 80% to determine minimum compressive strength requirements.

C. Curing and Finishing:
   1. Cure units in a warm, moist curing chamber at 95% relative humidity for 24 hours, or yard cure for 350 degree-days (i.e. 7 days @ 50°F. or 5 days @ 70°F.) prior to shipment.
   2. Acid-etch exposed surfaces to remove cement film prior to packaging for shipment.

2.3 REINFORCING AND ANCHORS

A. Reinforcing Bars: ASTM A 615, Grade 60. Bars shall be hot-dipped zinc coated after fabrication in accordance with ASTM A 123.

B. Reinforcing Mesh: ASTM A 185, No. 3 gage zinc-coated wire rods electrically welded on 4" centers each way.

C. Anchors, inserts, and dowels shall be corrosive resistant, galvanized, brass or stainless steel Type 304.

D. Cast stone panels shall be reinforced as may be required for handling, and to allow for temperature changes and structural stress.

E. There shall be a minimum steel reinforcement amounting to ¼ percent of the cross-section area of the panel and should the panel be greater than 12" in any sectional dimension, the temperature steel shall be placed in both directions.

F. Reinforcement shall be galvanized or epoxy coating when covered with less than 1-1/2" of material.

2.4 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, white, domestic manufacture.

B. Lime: ASTM C 207, Type S.

C. Sand: ASTM C 144, clean, washed, masonry natural sand.

D. Color: ASTM C979, Non-fading, iron oxide, limeproof pigment to produce mortar custom color as selected by Architect to match cast stone. The Architect shall approve the actual color sample of mortar before proceeding with grouting or pointing.

E. Water: Clean and free of deleterious amounts of acids, alkalies, or organic materials.

2.5 MORTAR MIXES

A. Setting Mortar: Proportions by volume:
   1 part Portland cement
   1 part lime
   6 parts white silica sand

B. Pointing Mortar: Proportions by volume:
   1 part Portland cement
   1 part lime
   6 parts white silica sand

C. Coloring agent as required to provide consistent custom color.

2.6 FABRICATION

A. General: Cast stone shall be Type I complying with ASTM C 1364, color as selected by Architect. Cast units shall be free from defects such as cracks, loose aggregate, broken edges, and marred finish surfaces which may affect appearance or serviceability. All units shall be equal in color and surface texture to approved samples.

B. The manufacturer shall be responsible to design a mix which achieves both the strength and the surface finish desired.

C. The average water absorption of cast stone shall not exceed 6% by dry weight when tested in accordance with the requirements of this specification.

D. All casting shall be done in accurate molds designed to withstand high frequency vibration. Steel reinforcement units shall be accurately placed. Vibration shall be continuous during the casting process until full specified thickness is reached and all excess water brought to the surface.

E. Curing: No cast stone shall be shipped to the project site until after it has been properly cured at the manufacturer's plant as specified.

F. Fabrication Tolerances: Comply with Cast Stone Institute Technical Manual (current edition).
1. Height and Width: Plus 1/16", minus 1/8"
2. Length:
   a. Up to 2'-0": Plus 1/16", minus 1/8"
   b. 2'-0" to 5'-0": Plus 1/8", minus 1/8"
   c. 5'-0" to 10'-0": Plus 1/8", minus 3/16"
3. Setting tolerances: Plus or minus 1/8" allowable out of plane from adjacent unit.
4. Joints: +1/16", -1/8".

PART 3 - EXECUTION

3.1 JOINTING

A. Joint Size:
1. At stone/brick joints - 3/8".
2. At stone/stone joints in vertical position - 1/4"
3. Stone/stone joints exposed on top side - 3/8".

B. Joint Material:
1. Use a full bed of mortar at all bed joints.
2. Sealant: Head joints in copings, and joints at column covers, cornices, platforms, soffits, window sills, and in general, all stone sections with projecting profiles, exposed top joints or rigid suspension connections to the supporting structure should be set with unfilled joints. After setting, prime the ends of stones, insert properly sized foam back-up rod to proper depth, and gun-in sealant.
3. Mortar: Masonry-bound trim such as belt courses, lintels, window surrounds, date stones, inscription blocks, quoins, keystones, similar applications, and vertical joints shall be mortar joints.
4. Rake all mortar joints 3/4" for either **pointing mortar or sealant as selected by Architect**.

C. Location of joints:
1. As shown on approved shop drawings.
2. Unless otherwise shown, at control and expansion joints per plan.

3.2 ERECTION

A. Stone shall be clean. Before setting, sponge or drench with clean water.

B. Set stone units level, square, and true with uniform mortar joints as specified.

C. All cast stone shall be set by experienced masons, accurately and in accordance with the shop and setting drawings.

D. Unless otherwise noted, every stone shall be set in a full bed of mortar.

E. Reference “Joint Materials” paragraph in the “Jointing” Article above for direction on erection/installation at the different joint areas.

F. All anchors and dowels shall be firmly placed and all anchor holes and dowel holes and similar holes filled completely with mortar or non-shrink grout.

G. All anchors, dowels and other anchoring devices shall be furnished by the setting contractor as shown on approved shop drawings using, whenever possible, standard building stone anchors commercially available in a non-corrosive material such as galvanized steel, brass or Type 304 stainless steel.

H. When setting with mortar, all stones not thoroughly wet shall be drenched with clear water just prior to setting.

I. After each stone has been set, all joints shall be raked to a depth of 3/4" from the face for pointing. The face of each stone shall then be sponged off to remove any splashed mortar or mortar smears.

J. Only the ends of lugged sills and similar stones shall be embedded in mortar. The balance of joint to be left open until pointing of stone work, than tuck points on face only to a depth of 3/4". Tuck point stone joints to a slight concave.

K. All stone shall be protected from splashing mortar or damage by other trades.

L. Form weep holes at the bottom of every vertical joint. Form weep holes with 1/4" oiled sash cord or plastic tubing and remove when the mortar has set.

M. Installation tolerances shall be in accordance with requirements of SECTION 04 20 00 - MASONRY UNITS.

3.3 TESTING

A. Testing shall be performed in accordance with ASTM C 31, ASTM C 39, ASTM C 642, and ASTM C 1194, except that 2" cube specimens shall be used, oven-dried in accordance with ASTM C 97.

B. Test three specimens per 500 cubic feet at random from plant production in accordance with referenced standards.

C. The results of compression tests shall be divided by a factor of 0.8 when saw-cut or core-drilled specimens are used.

3.4 PATCHING AND CLEANING

A. The repair of chipped or damaged cast stone shall be done only by mechanics skilled in this class of work, with materials furnished by the manufacturer and according to this direction.

B. Before pointing, the face of all cast stone shall be scrubbed with a fibre brush, using soap powder and water and shall then be thoroughly rinsed with clean running water. Any mortar on the face of the cast stone shall be removed. No acids or prepared cleaners shall be used without the approval of the cast stone manufacturer.

3.5 POINTING AND CAULKING

A. When ready for pointing, the joints shall be dampened and carefully pointed to a slight concave unless otherwise specified by the Architect. No pointing shall be done in freezing weather nor in locations exposed to hot sun, unless properly protected. The Architect shall approve color of pointing mortar before proceeding with pointing.

B. Head joints in copings and similar stones shall be caulked with a joint sealant used in accordance with the manufacturer's instructions.

3.6 INSPECTION AND ACCEPTANCE

A. Applicable standards for inspection and quality control shall be ACI Committee 311 Manual of Concrete Inspection and PCI MNL-117 Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products.

B. Cast stone shall show no obvious repairs or imperfections other than minimal color variations when viewed with the unaided eye at a 20 ft. distance in good typical daylight illumination.

3.7 PROTECTION

A. Cast stone shall be protected after erection and until final cleaning by non-staining rosin sized paper or polyethylene film of not less than 4-mil thickness.

B. Cast stone at entrances shall be protected until substantial completion is achieved.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Structural metal framing.

B. Related Sections:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 03 30 00 - Cast-in-place Concrete: grouting under base plates.
3. Section 05 21 00 - Steel Joists Framing.
4. Section 05 31 00 - Steel Decking.
5. Section 05 40 00 - Cold-formed Metal Framing: lightgage framing.
6. Section 07 81 16 - Cementitious Fireproofing.

1.2 SUBMITTALS

A. General:
1. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Contractor shall be responsible for omissions and errors and for conformance with the drawings and specifications relative to the various details.
3. Architect's review will cover member sizes, strength of connections and general arrangements but not dimensions or quantities.

B. Shop Drawings: Indicate shop and erection details, including cuts, copes, connections, holes, threaded fasteners and welds.

C. Product Data:
1. Provide Manufacturer's data and certification for pre-assembled bolt, washer, and nut.
2. Provide copy of Welders' Certification. Welders must show proof of certification within the last year prior to starting any welding on the project.

1.3 QUALITY ASSURANCE

A. Codes and Standards:
1. Fabrication and erection shall comply with the requirements of AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings", "Specifications for Structural Joints using ASTM A 325 or A 490 Bolts" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation and "Code of Standard Practices for Steel Buildings and Bridges", latest editions.
2. Welders and welding procedures shall comply with requirements of ANSI/AWS D1.3 Structural Welding Code.
3. Steel Structure Painting Council
a. Painting Manual, Volume 1, Good Painting Practice.
b. Painting Manual, Volume 2, Systems Specifications.
4. Research Council on Riveted and Bolted Structural Joints: "Specifications for Structural Joints using ASTM A 325 Bolts.

B. Design
1. Substitutions: Submit substitutions of sections or modifications of details, or both, and the reasons with the shop drawings for approval. Submitted substitutions must be clearly identified and noted as such. Coordinate approved substitutions, modifications, and necessary changes in related portions of the work by the fabricator and accomplish same at no additional cost to the Owner.
2. Responsibility for errors: The Fabricator shall be responsible for all errors of detailing, fabrications, and for the correct fitting of structural steel members.

1.4 QUALIFICATIONS

A. Structural Steel Fabricator: Not less than 10 years' experience in the fabrication of structural steel for buildings.

B. Structural Steel Erection: Not less than 5 years' experience in the erection of structural steel. Welders must be qualified to perform all procedures and positions encountered per AWS certification standards.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Bolts and other anchorage devices to be embedded in concrete and masonry shall be delivered to the site before the start of concrete or masonry work. Furnish setting drawings and templates for the installation of anchor bolts.

B. Fasteners shall be protected from dirt and moisture at the project site. Only as many fasteners as are anticipated to be installed and tightened during a work shift shall be taken from protected storage. Fasteners not used shall be returned to protected storage at the end of the shift. Fasteners shall not be cleaned of lubricant that is present in as- delivered condition.

1.6 PROJECT CONDITIONS

A. Coordinate erection of structural steel with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel:
1. ASTM A 36, typical Channels, Angles, Bars, and Plates.
2. ASTM A 992, W Shapes.

B. Hollow Structural Sections: ASTM A 500, Grade B and C.

C. Pipe Columns: ASTM A 53, Grade B.

D. Anchor Rods, Bolts, Nuts, and Washers:
1. Anchor Rods: ASTM F 1554, Grade 55.
2. Nuts: ASTM A 563, heavy hex Grade C, C3, D, DH, or DH3.
3. Washers: ASTM F 436.

E. High-Strength Bolts, Nuts, and Washers:
1. Heavy hex steel structural bolts: ASTM A 325, Type 1, uncoated.
2. Heavy hex carbon-steel nuts: ASTM A 563, Grade C, C3, D, DH, or DH3.
3. Hardened carbon-steel washers: ASTM F 436.

F. Tension Control Bolt Assemblies: ASTM F 1852; Lohr "High Strength Rapid Tension Bolts".

G. Shear Connectors: ASTM A 108, Grade 1015 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.

H. Shop Paint: SSPC-Paint 25, Type I, iron oxide, zinc oxide, raw linseed oil, and alkyd. Do not prime areas which are to receive sprayed-on fireproofing.

I. Bituminous Paint: Cold applied asphalt mastic, SSPC Paint 12, compounded for 30-mil thickness per coat.

2.2 FABRICATION

A. General: Fabricate structural steel in accordance with referenced specifications.
1. Drawings indicate the design, sections and weights of members. Make no substitutions except with the written permission of the Architect. Do not use dimensions scaled from the drawings for fabrication. Contractor shall, when necessary, determine actual dimensions at the building.

2. Workmanship shall conform to the best practice in structural steel shops. Materials shall be clean and straight. Shop kinks will not be permitted.
3. Exposed steel, where in view, shall meet the requirements of the AISC Manual for "Architecturally Exposed Structural Steel."

B. Connections shall conform to the standard specifications of the American Institute of Steel Construction.

C. Punching:
1. Shop-punch steel members for bolts and hanger rods needed to support wood nailers and other items.
2. At hollow structural sections located in the exterior building envelope, provide shop-punched holes in steel sections as indicated on drawings, for installation of sprayed foam insulation to completely fill hollow structural section cavity

D. Marking: Components of high strength steel required to have a yield stress greater than 36 kips/sq. in. shall be clearly marked with the ASTM designation over any shop coat prior to shipment from the fabricator's plant.

E. Shop Painting:
1. Do not paint steel surfaces to be welded, including top flange of steel beams that are to receive shear studs. Do not paint steel surfaces which are scheduled to receive sprayed-on fireproofing. Clean this steelwork of oil and grease with solvent cleaner and remove dirt and other foreign matter by sweeping with brushes or with compressed air.
2. Apply one coat of shop paint to steel. Prior to application of shop paint clean steel to remove loose mill scale, rust, weld slag, dirt, and other foreign matter. Clean welds of spatter, smoke, and iron oxide film. Remove oil and grease with solvent cleaner
3. Apply shop paint to dry surfaces thoroughly and evenly by brush, spray, roller coating, or dipping at the election of the fabricator.

PART 3 - EXECUTION

3.1 ERECTION

A. General: Comply with AISC Specifications and Code of Standard Practice, and as herein specified.

B. Erection of structural metal shall comply with the requirements of referenced codes and standards.
1. The use of a cutting torch for field correction of fabricating errors will be permitted only with the approval of the Architect. For each fabrication error the contractor shall submit a drawing of existing conditions and the proposed correction for the Architect's review.
2. Set column base plates to correct elevations; support temporarily on shims until the columns have been plumbed and grouted.
3. Make field connections by electric arc welding or with high-strength pre-assembled threaded fasteners.

C. Metal Protection: Apply two coats of bituminous paint to all steel members embedded or in contact with soil.

D. Make high-strength bolted connections in conformance with "Specifications for Structural Joints Using ASTM A 325 Bolts" as approved by the Research Council on Riveted and Bolted Structural Joints, November 13, 1985.
1. Prior to installation, clean bolts, nuts, and washers, if required. Dirt and noticeable rust on bolts, nuts, and washers will not be allowed.
2. Install Lohr "High Strength Rapid Tension Bolts" in accordance with the manufacturer's instructions.

E. Stud weld shear connectors through the steel deck to the steel beams using welding equipment and procedures recommended by the manufacturer of the stud anchors used.

F. Erect steel framing true and plumb; brace temporarily where necessary to handle all loads to which the structure may be subjected. The Contractor shall remove such bracing as part of his equipment. Securely connect all work to take care of dead load, wind, and erection stresses.

G. Steel framing members supporting and connected to metal panels shall be erected to ⅛" tolerance for entire member length in any direction.

H. Provide neoprene rubber bearing pads where steel beams bear on concrete.

3.2 FIELD QUALITY CONTROL

A. Inspection and Testing: Verification inspection and testing of all field connections shall be done by an Independent Testing Laboratory, and copies of the inspection and test reports shall be submitted to the Architect and Contractor. The cost of these inspections and tests shall be paid as specified in SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

B. High-Strength Bolted Connections: All bolted connections shall be visually inspected in accordance with manufacturer's specifications.

C. Welded Connections:
1. All field fillet welds shall be visually inspected in accordance with the applicable parts of AWS D1.1 Section 6, Inspection.
2. In addition to visual inspection, full penetration butt welds shall be subjected to ultrasonic testing in accordance with AWS D1.1, Section 6, Part C, Ultrasonic Testing of Groove Welds. Testing shall be performed on 100% of welds:
3. All welds that fail ultrasonic test shall be re-welded and re-tested until they pass the test.

D. Shear connectors:
1. Visual inspection and bend tests shall be performed in accordance with the applicable parts of AWS D1.1, Section 4, Technique.
2. In addition to the bend tests, 25 beams per floor shall be selected at random and on each beam five studs shall be hammered toward the center of the beam as per the manufacturer's recommendations. If any of the five studs show failure, all studs on the beam shall be hammered, and all that fail shall be replaced. For each beam with any defective studs, two additional beams shall be tested.

END OF SECTION

SECTION 05 21 00

STEEL JOISTS FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Open-web steel joists with bridging and attached bearing plates.

B. Related Sections:
1. Section 01 45 23 - Testing and Inspection Services.
2. Section 05 12 00 - Structural Steel Framing.
3. Section 05 31 00 - Steel Decking.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Shop drawings shall indicate joist type, number, size, spacing, bridging, connections and erection details.

1.3 QUALIFICATIONS

A. Manufacturer shall be a member of S.J.I. and shall have engaged in the design and manufacture of similar units for a period of not less than 5 years.

B. Installer shall have minimum 2 years experience in similar sized projects and all welders shall be certified using AWS testing procedures.

1.4 QUALITY ASSURANCE

A. Reference Standards: The term "Standard Specifications" as used refers to latest editions of "Standard Specifications for Open Web Steel Joists" and "Standard Specifications for Longspan Steel Joists" as adopted by the Steel Joist Institute.

B. Erection Tolerances: Sweep in joists when erected shall not exceed ⅛" per foot of length.

C. All exposed steel joists shall comply with the finish requirements for “Architectural Exposed Steel”.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Joists: Open web, parallel chord, load carrying members of hot-rolled or cold-formed steel designated and fabricated in accordance with the "Standard Specifications".
1. Joists shall be cambered and shall fulfill their design requirements.
2. Joist bottom chords shall be double angles.
3. Provide extended ends for top chords of joists where indicated.

B. Shop Paint: SSPC-Paint 15, Type I, red oxide; Fed. Spec. TT-P-636, red oxide; or manufacturer’s standard shop primer complying with performance requirements of either of these red-oxide primers.

C. Welding Materials: AWS D1.1; type required for materials being welded.

D. Joist Accessories: ASTM A 36 quality for bridging, sidewall anchors, joist leg extensions and wall connectors as required.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Erecting Joists: Set joists to spacing shown with bearing areas in accordance with the "Standard Specifications". Provide headers, trimmers and bearing plates.
   1. Anchor ends of joists to masonry supports with bar anchors, bolts, or welding.
   2. Anchor ends of joists to steel supports by welding.
   3. Before construction loads are applied, align the joists as shown on the drawings and install bridging and bridging anchors.
   4. Repair or replace any damaged joists.

B. Coordinate placement of anchorages in masonry construction for securing bearing plates.

C. Field weld joist seat to placed bearing plates after alignment and positioning are complete. Execute welding in accordance with AWS standards by welders who have been previously qualified for positions and base metals encountered.

D. Do not permit erection of decking until joists are braced and bridged.

E. Do not field cut or alter joists without approval of Architect/Engineer.

F. After erection, prime welds, abrasions and surfaces not primed. Use primer consistent with shop coat.

G. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections and abraded areas of shop paint and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

3.2 ERECTION TOLERANCES

A. Maximum Variation From Plumb: ¼".

B. Maximum Offset From True Alignment: ¼".

3.3 FIELD QUALITY CONTROL

A. Inspection and Testing: Verification inspection and testing of all field connections shall be done by an Independent Testing Laboratory, and copies of the inspection and test reports shall be submitted to the Architect, Engineer, City, Owner and Contractor. The cost of these inspections and tests shall be paid as specified in SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

B. High-Strength Bolted Connections: All bolted connections shall be visually inspected in accordance with manufacturer's specifications.

C. Welded Connections: All field welds shall be visually inspected in accordance with the applicable parts of AWS D1.1 Section 6, Inspection.

END OF SECTION

SECTION 05 31 00

STEEL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Steel floor decking and roof decking.

B. Related Sections:
1. Section 05 12 00 - Structural Steel Framing.
2. Section 05 21 00 - Steel Joists Framing: Structural framed openings larger than 18".
3. Section 05 50 00 - Metal Fabrications: Framing deck openings with miscellaneous steel shapes.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Indicate type of deck, gage and finish of metal, and shape and size of special pieces and accessories. Indicate fastening to supporting structure and side lap fastening.

1.3 QUALITY ASSURANCE

A. Manufacturer: Shall have a minimum of 5 years experience in the design and manufacture of metal deck units.

B. Installer: Company specializing in performing the work of this section with minimum 3 years documented experience.

C. Welders must show proof of certification within the last year prior to starting any welding on the project. Welders and welding procedures shall comply with the requirements of ANSI/AWS D1.3 Structural Welding Code or as shown in the Steel Deck Institute Manual of Construction with Steel Deck.

D. Label Construction: Floor deck units shall be Listed by Underwriters Laboratories as a "Steel Floor and Form Unit" and shall bear the UL Classification Marking.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.

B. Store decking under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIRE-MENTS on wood sleepers with slope for positive drainage.

1.5 COORDINATION

A. Coordinate installation with structural steel erection. Do not proceed until structure is ready to receive metal decking.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers; Subject to compliance with requirements, provide products by the following:
Canam United States; Canam Group, Inc.
Nucor Corp.; Vulcraft Division

2.2 MATERIALS

A. Roof Decking: Provide 1-1/2" deep 22 gage wide rib deck units with ribs spaced 6" o.c. Deck plate shall have a flat surface; ribbed top flange is not acceptable. Product/manufacturer; one of the following:
Type 1.5B Roof Deck; Nucor Corp.; Vulcraft Division

B. Roof Decking: Provide 1.0 CSV form deck, 22 gage, G90 deck as manufactured by Nucor Corp.; Vulcraft Division.

C. Finish: Roof decking units shall have a light commercial class zinc coating in accordance with ASTM A 653, Class G90.

2.3 ACCESSORIES

A. Fasteners: Galvanized hardened steel.

B. Weld Washers: Mild steel, uncoated 3/4" outside diameter, 1/8" thick.

C. Screws: #10 x 3/4 - HWH TEKS/1 self-drilling screw manufactured from galvanized heat treated carbon steel as manufactured by "Buildex".

PART 3 - EXECUTION

3.1 ERECTION

A. Placement: Place steel deck units on the supporting steel framework and adjust to final position before fastening permanently. Bring each unit to proper bearing on the supports. Place the units in straight alignment and with a minimum of clearance between the ends of abutting units. Deck units shall be continuous over at least three spans.

B. Fastening: Weld deck units to steel framework at ends and at intermediate supports with 3/4" diameter fusion welds. Space welds as indicated on structural drawings.
1. Fasten side joints of roof decking together at mid-span with No. 10 self-tapping screws.
2. Fasten side joints of floor decking together by tack welding or mechanical crimping.

C. Opening: As the steel deck units are erected, cut and form the holes and openings which are located and dimensioned on the drawings. Holes required for the work of the other trades will be cut by the trades requiring them. Provide deck reinforcing for openings as recommended by the manufacturer.

3.2 FIELD QUALITY CONTROL

A. Inspection and Testing: Verification inspection and testing of all field connections shall be done by an Independent Testing Laboratory, and copies of the inspection and test reports shall be submitted to the Architect, Engineer, City, Owner, and the Contractor. The cost of these inspections and tests shall be paid as specified in SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Lightgage structural metal studs in exterior wall systems used as masonry veneer back-up and used as metal panel back-up.

B. Related Sections:
1. Section 05 12 00 - Structural Steel Framing.
2. Section 05 50 00 - Metal Fabrications: steel angles.
3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System.
4. Section 07 42 13 - Metal Wall Panels.
5. Section 07 48 00 - Rainscreen Attachment System (MFI)
6. Section 09 21 16 - Gypsum Board Assemblies: non-loadbearing partition studs.

1.2 SYSTEM DESCRIPTION

A. Masonry Veneer: The exterior non-load-bearing curtain wall system shall be designed to withstand both positive and negative pressure with a maximum deflection of L/600 of stud span. If stud span for 6" and 8" 18 gage stud exceed L/600, either increase stud gage, decrease stud spacing, or add light-gage bracing to control deflection to L/600.

B. All Other Veneer/Cladding: The exterior non-load-bearing curtain wall system shall be designed to withstand both positive and negative pressure with a maximum deflection of L/240 of stud span. If stud span for 6" and 8" 18 gage stud exceed L/240, either increase stud gage, decrease stud spacing, or add light-gage bracing to control deflection to L/240.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site prior to commencing Work. Attendees shall include Architect’s Structural Engineer, Cold-Formed Metal Framing Engineer, Cold-Formed Metal Framing Installer, and Owner’s Testing Lab.

1.4 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's specifications, load tables, dimension diagrams, anchor details, installation instructions for products to be used in lightgage framing work, and type and location of fasteners. Describe materials and finish, product criteria, and limitations.

B. Structural Calculations: Submit structural calculations prepared by manufacturer for review by project engineer.
1. Description of design criteria.
2. Engineering analysis depicting stress and deflection (stiffness) requirements for each framing application. This shall include cold-formed steel angles around exterior glazing system openings, exterior door openings, and exterior louver openings as detailed.
3. Selection of framing components and accessories.
4. Verification of attachments to structure and adjacent framing components.
5. Sealed by a professional engineer registered in the state where the project is located.
6. Engineer shall have a minimum of 5-years’ experience with projects of similar scope.

C. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Drawings shall incorporate fabrication and erection details.

D. Evaluation Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. All structural members shall be designed in accordance with AISI "Specifications for the Design of Cold-Formed Steel Structural Members", latest edition.

B. Qualifications: Welders and welding procedures shall comply with the requirements of ANSI/AWS D1.3 Structural Welding Code.

1.6 DELIVERY AND STORAGE

A. Protect metal members from rusting and damage. Deliver to project site in manufacturer's containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry, ventilated space.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lightgage Steel Framing: Basis of Design ClarkDietrich Building Systems (phone 800.543.7140 web site: www.clarkdietrich.com). ASTM A 1003, Provide Metal Framing, 18 gage minimum with 1-5/8” flange minimum, structural stud framing members. Refer to structural drawings for specific size, type, and locations of framing which may be used on the project.

B. Substitutions: Under provisions of SECTION 01 62 00 - PRODUCT OPTIONS. Other acceptable manufacturers with products of equal substance and function include:
CEMCO Steel
Marino\Ware
Mill Steel Company
The Steel Network

C. Furnish bridging and bracing members shown or required for a complete and structurally sound installation.

D. Track: Formed steel; channel shaped; same width and finish as studs, tight fit; 18 gage thick, solid web.

2.2 ACCESSORIES

A. Slide Clips: ASTM A 653, Grade A, galvanized metal clip.
1. ASTM A 653, Grade C, galvanized metal clip.
2. Designed and manufactured for attachment of metal stud framing to edge of structural steel framing.
3. Permits differential vertical movement between stud and floor or roof structure.
4. Clip and its connection to structure shall be adequate to safely brace metal studs to resist design lateral load of at least 330 pounds (allowable stress increase permitted by Building Code already taken into account).

B. Bracing and Furring: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

C. Bridging: 1-1/2" C.R. channels, 16 ga; same finish as framing members.

D. Plates, Gussets, Clips: Formed sheet steel, thickness determined for conditions encountered, manufacturer's standard shapes, same finish as framing members.

E. Galvanizing Repair Paint: Organic Zinc-Rich coating containing 95% metallic zinc, by weight in the dried film; recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to Federal Specification DOD P-21035A for repair of hot-dip galvanizing; as manufactured by ZRC Worldwide (phone 800.831.3275 web site: www.zrcworldwide.com). Provide Z.R.C. Cold Galvanizing Compound.

F. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer’s standard widths to match width of bottom track or rim track members as required.

G. Glazing System, Door and Louver Perimeter Angle:
   1. This shall include cold-formed stainless steel angles around exterior glazing system openings, exterior door openings and exterior louver openings as detailed.
   2. Fabricate perimeter angle from ASCE/SEI 8-02, Type 304 stainless steel sheet.

H. Supplementary Framing: Fabricate other steel-framing accessories from ASTM A 1003, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated.

2.3 FASTENERS

A. Self-drilling, Self-tapping Screws, Bolts, Nuts and Washers: ASTM A 90, hot dip galvanized.

B. Anchorage Devices: Power driven as recommended by manufacturer for size and spacing.

C. Welding Electrodes: Comply with AWS standards D1.1 and D1.3.

D. Post-Installed Anchors (for securing perimeter angle to masonry or concrete structure): Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate; zinc coated by hot-dip process according to ASTM A 153, Class C.

2.4 FABRICATION

A. General: Framing components may be prefabricated into panels prior to erection. Cut framing components accurately to fit squarely against abutting members. Hold members firmly in position until properly fastened. Prefabricated panels shall be square and braced against racking. Attach similar components by welding.

B. Protective Finishing: Paint abraded surfaces and welds after fabrication, using galvanizing repair paint for galvanized surfaces.

2.5 FINISHES

A. All framing members shall be formed from hot-dip galvanized steel, G90 (Z275) coating at coastal areas, conforming to the requirements of ASTM A 1003, Structural Grade, Type H.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install steel framing members and accessories in accordance with the manufacturer's instructions and the erection drawings. Spacing of studs shall not exceed 16" o.c.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

C. Securely anchor track to floor and overhead structure or member. Seat studs squarely in the track with the stud flange securely attached to the flanges of both upper and lower track.
   1. Attach structural components by welding, bolting or with self-drilling screws.
   2. Wire tying of framing components in structural applications will not be permitted.

D. Touch-up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thinness of 2.0 mils. For galvanized surfaces, apply galvanizing repair paint.

E. Construct corners using minimum three studs. Double stud at wall opening, door, and window jambs.

F. Provide vertical stud within 12 inches of jamb for brick anchor attachment at openings. Reference BIA Technical Note 28B.

G. Provide rows of horizontal bridging welded in place at spacing recommended by stud manufacturer to resist lateral forces and stud rotation.

3.2 TOLERANCES

A. Maximum Variation from True Position: ±1/8" from plan location.

B. Maximum Variation of any Member from Plane: 1/8" in 10 feet.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous metal work and related items.

B. Related Sections:
1. Section 05 12 00 - Structural Steel Framing.

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance of Railings: 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 lbf/ft. applied in any direction.
b. Concentrated load of 250 lbf 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 lbf/ft. applied in any direction.
b. Concentrated load of 250 lbf 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 lbf applied horizontally on an area of 1 sq. ft.
b. Infill load and other loads need not be assumed to act concurrently.

1.3 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include details of each metal fabrication, including setting drawings for anchor bolts and other required anchors.

B. Submit structural calculations prepared by manufacturer for review by project engineer. Shop drawings and calculations shall be sealed by a professional engineer registered in the State of Texas.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: ASTM A 36, shapes, plates and bars.

B. Threaded Fasteners: ASTM A 307, Grade A, bolts and nuts.

C. Stud Anchors: Provide headed stud anchors with a smooth shank of carbon steel with a minimum tensile strength of 60,000 psi, as manufactured by Nelson Stud Welding Div. or KSM Welding Systems Div.

D. Expansion Bolts: Fed. Spec. FF-S-325, Group II, Type A, Class 1. Provide Hilti Kwik-bolt or Ramset Trubolt stud anchors.

E. Galvanizing Repair Paint: Organic Zinc-Rich coating containing 95% metallic zinc, by weight in the dried film; recognized under the Component Program of Underwriter's Laboratories, Inc. as an equivalent to hot-dip galvanizing; conforming to Federal Specification DOD P-21035A for repair of hot-dip galvanizing; as manufactured by ZRC Worldwide, Marshfield, MA (phone 800.831.3275 web site: www.zrcworldwide.com). Provide Z.R.C. Cold Galvanizing Compound.

2.2 FABRICATION

A. Fabricate and assemble metal work in the shop to the greatest extent possible.
   1. Metal surfaces shall be clean and free of mill scale and rust pitting, well-formed to shape and size with sharp lines and angles. Shearing and punching shall leave clean true lines and surfaces. Exposed ends and edges shall be milled smooth with corners slightly rounded.
   2. Weld shop connections to the extent practical; finish exposed welds smooth. Weld joints shall be flush.
   3. Cut, drill or punch holes; do not make or enlarge by burning. Provide holes where required for connecting the work of other trades.
   4. Conceal fastenings where practical. Thickness of metal and method of assembly and support shall give ample strength and rigidity.
   5. Assemble parts so that joints are tight, members are in good alignment, and the finished work reproduces the drawing details as intended.
   6. Stud Anchors: Weld stud anchors to miscellaneous shapes using welding equipment and procedures recommended by the manufacturer of the stud anchors used.

B. Shop Painting:
   1. Carbon steel surfaces shall be cleaned, degreased, and shop coated with a straight alkyd, zinc chromate, rust inhibitive paint applied by brush or spray. Steel to be encased in concrete need not be painted.
   2. Aluminum surfaces to be in direct contact with concrete and masonry shall be shop coated with zinc chromate primer.

C. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized, as follows:
   1. ASTM A 153 for galvanizing iron and steel hardware.
   2. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip ⅛" thick and heavier, and for galvanizing assembled steel products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Deliver, store and erect metal work in such manner that the parts are not damaged or deformed. Install the work true to line, plumb, level, in proper alignment with other work, and free of sags, buckles and other objectionable defects. Anchorage shall be adequate to safely resist all stresses to which the work will normally be subjected.

B. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint and paint exposed areas with same material used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils. For galvanized surfaces, apply galvanizing repair paint.

3.2 MISCELLANEOUS METAL SCHEDULE

A. General: The following is a general list of the metal work to be furnished under this section of the specifications. Other items of miscellaneous metal work shown and noted on the drawings and not mentioned elsewhere in the specifications shall be furnished as though specifically described herein.

B. Loose Lintels: Lintels of steel shapes and plates where required at exterior brick veneer and as detailed.
   1. End bearing shall be at least 8".
   2. Where steel lintels are not specifically called out, furnish at least one steel angle for each 4" thickness of masonry in the wall.
   3. Wrap bearing ends of lintels with flashing to achieve a bond breaker between the lintel and the masonry.
   4. Galvanize steel lintels located in exterior walls.

C. Pipe Rails: Handrails and railings of standard black steel pipe with fittings as detailed.
   1. Bend pipe to smooth curves without kinks. Make joints and connections flush and smooth. Grind rough edges and exposed welds smooth; dress to profile.
   2. For railings, space the posts as shown but not more than 4 ft. apart. Install posts into pipe sleeves set in the concrete; grout each post tight with low viscosity epoxy grout.
   3. Provide slip flanges where posts are set into concrete and where rails terminate against walls.
   4. Railings shall be designed and installed to meet the TAS requirement of withstanding 250 lbf. pressure applied in any direction at any point on the railing.
   5. Galvanize exterior pipe handrails and railings after fabrication.

D. Bollards: Provide bollards of size indicated, extend 3' below grade and 4' above grade, fabricated of Schedule 40 steel pipe, galvanized with G90 coating. Fill bollards with 3000 psi concrete, finish with domed top.
   1. At existing slabs, fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
   2. Removable Embedded: Reference SECTION 12 93 00 – SITE FURNISHINGS.

E. Roof Curbs: Fabricate curbs of steel angles, channels and plates at roof openings for ducts, exhaust fans and other set-on items.
   1. Miter and weld corners.
   2. Bolt or weld curbs to roof framing members.

F. Roof Edge Angles: Provide steel angles along roof edges to support wood nailers.
   1. Weld angles to steel framing unless otherwise indicated.

G. Ladders: Fabricate ladders of steel bars and shapes.
   1. Weld all connections.
   2. Bolt ladders to floor and wall with steel brackets and clips.
   3. Ladder Rungs: Provide SlipNOT®, grit-free, mill finish steel Grade #2 – Medium rungs as manufactured by the W.S. Molnar Company (1-800-SlipNOT) or approved equivalent. Reference drawings for dimensions. Steel shall incorporate an anti-slip primarily martensitic steel surface covering 100% of the substrate consisting of a random hatch matrix with a surface hardness between 55 – 63 on the Rockwell “C” scale and a surface to substrate bond strength of at least 4,000 psi. The non-slip surface shall have a minimum coefficient of friction of 0.8 and be listed as slip resistant by Underwriters Laboratories.
   4. Galvanize exterior ladders after fabrication. Reference Manufacturer’s galvanizing guidelines, as to not damage the anti-slip surface.

H. Structural Steel Door Frame for Jamb Mounted Rolling Doors: Frames of carbon steel shapes, bars and plates, fully welded, uniform, square, and true, as detailed for the rolling doors.
   1. Miter and weld corner joints and grind exposed welds smooth.
   2. Weld 14 gage strip anchors to frame jambs, spaced 24" o.c. to work masonry bed joints.
   3. Continuously weld exposed joints; grind exposed welds smooth.
   4. Provide necessary reinforcements and drill and tap as required for finish hardware.
   5. Galvanize exterior structural steel door frames and anchors.

I. Downspout Boots: Stainless steel. Provide Piedmont Model #SO or approved equivalent.
   1. Provide sizes and configurations indicated on drawings.
   2. Provide tamper proof clean out cover.
   3. Boots shall be factory prefinished fluorocarbon coating containing 70% Kynar 500.

J. Miscellaneous Steel Shapes: Channels, wide flange shapes, angles, plates, tubing, connections, and bolts where shown and detailed on Drawings. Hot-dip galvanize where exposed to weather or touching exterior masonry after fabrication. Set mechanical unit frames directly on joists, not on deck. Provide an angle frame supported by structure around all roof penetrations including hatches and ductwork.

END OF SECTION

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SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Framing with dimension lumber, wood blocking and nailers, wood furring and grounds, and plywood backing panels.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data:
1. Include all data for rough carpentry products required for installation.
2. Fire-retardant-treated wood product data, including certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.

C. Warranty: Provide warranty of chemical treatment manufacturer for each type of treatment.

1.3 QUALITY ASSURANCE

A. Lumber Grading: Lumber Grading Rules and Wood Species in accordance with Voluntary Product Standards. Grading rules of following associations apply to materials furnished.
1. Southern Pine Inspection Bureau (SPIB).
2. West Coast Lumber Inspection Bureau (WCLIBB).
3. Western Wood Products Association (WWPA).

B. Grade Marks: Identify lumber and plywood by official grade mark.
1. Lumber: Include symbol of grading agency, mill name, grade, species, grading rules and condition of seasoning at time of manufacturer.
2. Plywood: Include type, span rating or group number, exposure durability classification, and agency mark of APA.

1.4 QUALIFICATIONS

A. Design structural site fabricated items under direct supervision of a professional structural engineer experienced in design of this work and licensed in the State of Texas.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store products above ground, on platforms or skids, and covered with waterproof coverings. Provide for adequate air circulation.

C. Do not store seasoned materials in damp or wet locations.

D. Support products in such a way as to prevent warping and distortion.

1.6 WARRANTY

A. Provide a 20-year warranty for each type of chemical treatment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wood: Lumber for general carpentry work shall be sound, well manufactured, surfaced S4S material with a moisture content limit of 19%.
   1. Dimension: SPIB grade marked No.2 Dimension Southern Pine or WCLB grade marked No. 2 Dimension Douglas Fir.
   2. Boards: SPIB grade marked No. 2 Boards Southern Pine.

B. Plywood: Plywood for general carpentry work shall be APA trademarked, 23/32" minimum thickness, Tongue & Groove.
   1. Interior: B - D, Group 2, Exposure 1, fire-retardant treated.
   2. Exterior: C - C plugged grade, Group 2, Exterior type, fire-retardant treated.

C. Rough Hardware:
   1. Anchors, bolts, screws, and spikes shall be of proper types and sizes to support the work, to draw the members into place, and to hold them securely. Bolt heads and nuts bearing on wood shall have standard washers.
   2. Metal fasteners to secure wood grounds and blocking to masonry and concrete shall be of the type best suited to the conditions and spaced no more than 16" o.c. Wood plugs and nailing blocks are not acceptable.
   3. Nails shall be of the sizes and types intended for the particular use.
   4. Rough hardware exposed to the weather or embedded in exterior masonry and concrete walls or slabs shall be hot-dipped galvanized.
   5. Nails and bolts used with preservative treated lumber shall be hot-dipped galvanized.

2.2 WOOD TREATMENT

A. Preservative Treatment:
   1. Comply with applicable requirements of AWPA U1; Category UC2 for interior construction not in contact with ground, Category UC3b for exterior construction not in contact with ground, and Category UC4a for items in contact with ground.
      a. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
      b. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
   2. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19% for lumber and 15% for plywood. Do not use material that is warped or that does not comply with requirements for untreated material.
   3. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
   4. Application: Treat items indicated on drawings, and the following:
      a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
      b. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
      c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
      d. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
      e. Wood floor plates that are installed over concrete slabs-on-grade.

B. Fire-Retardant Treatment:
   1. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   2. Wood shall be fire-retardant chemically treated and pressure impregnated; with a flame spread index of 25 or less and a smoke development of 0-450 when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   3. Treatment shall not promote corrosion of metal fasteners.

4. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
5. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
6. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841
7. Kiln-dry lumber and plywood after treatment to maximum moisture content of 19% for lumber and 15% for plywood.
8. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

C. If cut after treatment, coat cut surfaces with heavy brush coat of same chemical used for treatment. Inspect each piece of lumber or plywood after drying; discard damaged or defective pieces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General
1. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.
2. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted. Scribe and cope as required.
3. Securely attach carpentry work to substrates by anchoring and fastening as required by recognized standards and as required to draw members into place and securely hold same unless otherwise indicated. Use washers under all bolt heads.
4. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials.
5. Make tight connections between members to develop full strength of members.
6. Install fasteners without splitting of wood.
7. Pre-drill as necessary.
8. Comply with APA E30 requirements for plywood.
9. Install fasteners at spacings recommended by AFPA National Design Specifications for Stress Grade Lumber and Its Fastening - 1973 for lumber and APA Guide E30 for Plywood, unless more restrictive code requirements dictate tighter spacing or heavier fasteners.
10. Locate members as indicated on the drawings. Size, spacing or spans shall not be changed without specific approval of Architect. Take care to place proper grades and species of members where indicated in accordance with the lumber schedule herein.
11. Temporary brace framing at the end of each days' work until all framing is completed and securely anchored. Leave temporary bracing in place as long as required for safety. As work progresses, securely connect work to compensate for dead load, wind and erection stresses.

B. Shoring: Construct shoring for masonry where required. Brace and maintain it until the mortar has set sufficiently to permit removal.

C. Nailers: Install nailers of adequate size where detailed. Nailers shall be bolted in place. Where bolt sizes and spacing are not specifically noted, use not less than ⅜" bolts at 32" o.c., staggered.

D. Roof Curbs: Construct wood curbs as detailed to frame openings and support flashings in roof decks.

E. Bucks: Install wood bucks for frames as required. Members shall be at least 2 x 4 material. Spike securely together. In masonry, provide 16 ga. corrugated metal jamb anchors screwed to the back and spaced to work masonry bed joints, not more than 32" apart.

F. Plywood Backing Panels: Screw attach through gypsum board to supports.

3.2 PROTECTION

A. Protect products from moisture absorption and subsequent warping or deterioration until subsequent construction can proceed.

END OF SECTION

SECTION 06 16 56

AIR- AND WATER-RESISTIVE SHEATHING BOARD SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vapor-permeable, air- and water-resistive wall sheathing.
2. Site-fluid-applied, vapor-permeable air barrier flashing.
3. Accessories.

B. Related Sections:
1. Section 01 45 00 - Quality Control: for general mockup requirements.
2. Section 05 40 00 - Cold-Formed Metal Framing: for structural framing support of panels.
3. Section 07 11 13 - Bituminous Dampproofing; behind below-grade masonry veneer and at non-conditioned buildings.
4. Section 07 27 26 - Fluid-Applied Membrane Air Barriers: air barrier on masonry backup.
5. Section 07 65 00 - Flexible Flashing: for flexible flashing components integrating with transition materials specified in this Section.
6. Section 07 92 00 - Joint Sealants: for backing materials.
7. Division 07 roofing Sections for roof assembly air barriers and interface coordination.
8. Section 09 21 16 - Gypsum Board Assemblies: for wall sheathing requirements for portions of the Work not requiring board product air barriers specified in this Section.

1.2 DEFINITIONS

A. Air barrier Accessory: A transitional component of the air barrier that provides continuity.

B. Air barrier Assembly: The collection of ABs and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air barrier Material (AB): Air tight barrier made of material that is relatively air impermeable but moisture vapor permeable, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

D. Material Transitions: Areas where the WRB/AB fiberglass-mat gypsum sheathing connects to beams, columns, slabs, parapets, foundation walls, roofing systems, and at the interface of dissimilar materials.

E. Rough Openings: Openings in the wall to accommodate windows and doors.

F. Water-Resistive Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, and installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Coordinate installation of board product air barriers with framing installation and subsequent operations that impact finished envelope air barrier work.
2. Coordinate installation of joint sealants with cleaning of joint sealant substrates and other operations that may impact installation or finished joint sealant work.

B. Preinstallation Conference: Conduct conference at the Project site.
1. Review board product air barrier accessory materials installation, including joints between sheathing boards and transitions to abutting construction including air barriers work of other Sections. Review requirements for forming and sealing penetrations of air barrier by other trades.
2. Review requirements for each type of air barrier product and installation, project and manufacturer's details, mockups, testing and inspection requirements, and coordination and sequencing of air barrier work with work of other Sections.
3. Review manufacturer's written instructions for meeting Project requirements for substrates specified, including three-dimensional video model demonstrating proper application of components at wall openings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of air barrier product assembly and accessory. Indicate assembly component materials and dimensions and include construction and application details.
   1. Include data for framing preparation instructions and recommendations.
   2. Include data for substrate preparation instructions and recommendations.
   3. Include data for air- and water-resistive sheathing board assembly product data.
   4. Include standard drawings illustrating manufacturer's written installation and finishing instructions applicable to Project, including details for joints, counterflashings, penetrations, terminations, and tie-ins to adjacent construction.

B. Shop Drawings: For locations and extent of WRB/AB system.
   1. Include details of typical conditions, special joint conditions, and intersections with other building envelope systems and materials.
   2. Include counter flashings and details showing bridging of envelope at substrate changes.
   3. Detail sealing penetrations and flashing around windows and doors.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. Manufacturer Product Certificates: Indicate compliance with requirements of specified products under Performance Requirements or indicated on Drawings.

C. Fire-Propagation Characteristics Certificate: From a qualified testing agency, documentation that air barrier system as a component of a wall assembly has been tested or engineered to pass NFPA 285. Include system classification number of testing agency on Shop Drawings.

D. Product Certificates: Indicate compliance with requirements of specified products in "Performance Requirements" Article or as indicated on Drawings.

E. Product Test Reports: For each air barrier product, and air- and water-resistive sheathing board assembly, for tests performed by a qualified testing agency.

F. Sample Warranties: For manufacturer’s warranties.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified air barrier manufacturer experienced in manufacture of air barrier as one of its principal products.

B. Installer Qualifications: An experienced entity that employs applicators trained in application of specified products.

C. Testing Agency Qualifications: Qualified independent agency experienced in installing specified waterproofing system and qualified to perform observation and inspection specified in "Field Quality Control" Article to determine Installer's compliance with the requirements of this Project. Testing agency to be acceptable to Architect and retained by the Owner.

D. Mockups: Provide air barrier mockup application within mockups required in other Sections, or if not specified, in an area of not less than 64 sq. ft. of wall surface where directed by Architect for each type of backup wall construction. Include examples of surface preparation, crack and joint treatment, air barrier application, and flashing, transition and termination conditions. Build mockups to set quality standards for materials and execution.
   1. Include air barrier system tie-in details between walls and roof, and with wall and foundation wall. Include penetrations and openings.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, unopened packaging and store in an enclosed shelter providing protection from damage and exposure to the elements.
   1. Store within temperature limits required by manufacturer.
   2. Store air- and water-resistive sheathing board supported on risers on a flat platform.
   3. Comply with manufacturer's written instructions requirements for safety and handling.

B. Discard liquid materials that cannot be applied within their stated shelf life.

C. Store accessory materials in a location with constant ambient temperatures of 40 to 80 deg F.

1.8 FIELD CONDITIONS

A. Cold Weather Conditions:
   1. Site Fluid-Applied, Vapor-Permeable Joint Flashing: Comply with manufacturer's cold weather application written instructions when atmospheric temperatures or substrate surface temperatures are less than 40 deg F.
   2. Accessories and Sealants: Comply with manufacturer’s cold weather application instructions when atmospheric temperatures or substrate surface temperatures are less than 40 deg F.

B. Exposure: Comply with manufacturer’s limitations on exposure of applied product.
   1. Do not apply air barrier joint flashing to sheathing surface that is frozen or has frost.

C. Protect adjacent substrates from environmental conditions that affect air barrier performance.

D. Coordinate installation of membrane air barrier with completion of roofing, below grade, factory fluid-applied membrane portion to site fluid-applied membrane portion and other work requiring interface with air barrier.

E. Schedule work for inspection of air barrier applications prior to concealment.

F. Ensure ABs are cured before covering with other materials.

1.9 WARRANTY

A. Manufacturer's Warranty for Air Barrier System:
   1. Warranty Period for Air- and Water-Resistive Sheathing Board Assembly: Watertight for a period of ten years from date of Substantial Completion.

B. Manufacturer's Warranty for Site Fluid-Applied Air Barrier Products: Manufacturer agrees to furnish and install AB to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as a water-resistive barrier and air barrier, as defined in the applicable IBC and IECC, under normal use within specified warranty period.
   1. Manufacturer will, at its option, replace nonconforming Product or refund the purchase price of quantity of product shown to be nonconforming.
   2. Access for Repair: Provide air barrier system manufacturer with unimpeded pre- and post-occupancy access to Project facility and air barrier system for purposes of testing, leak investigation, and repair, and to reinstall removed cladding materials upon completion of repair.
   3. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain fluid-applied flashing materials and air barrier accessories from single source from single manufacturer.

B. Low-Emitting Materials: Fluid-applied flashing and accessories shall comply with testing and product 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."

2.2 PERFORMANCE REQUIREMENTS

A. Air- and Water-Resistive Performance: Air- and water-resistive board assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier system and as a water resistive barrier flashed to direct incidental water to wall exterior, and interface with adjacent building air barrier system components.
   1. Air- and Water-Resistive Board Assemblies: Capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations and transitions at perimeter conditions without deterioration and air-leakage exceeding specified limits.

B. Air Permeance of Sheathing: Maximum 0.04 cfm/sq. ft of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2178.

C. Air- and Water-Resistive Board Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

D. Water Penetration under Static Pressure: Test according to ASTM E 331, as follows:
   1. No evidence of water penetration through air barrier board assembly when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 2.86 lbf/sq. ft.

E. Water Vapor Permeance; Panel Assembly: Minimum 10 perms (580 ng/Pa x s x sq. m) as tested according to ASTM E 96/E 96M, Procedure B.

F. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by a qualified testing agency.

G. Surface-Burning Characteristics: Comply with ASTM E 84; 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.

H. Fire Propagation Characteristics: Provide air- and water-resistive board assembly qualified as a component of a comparable wall assembly that has been tested or engineered to pass NFPA 285.

2.3 WALL SHEATHING

A. Air- and Water-Resistive Sheathing Board: ASTM C 1177/C 1177M, glass-mat-faced gypsum sheathing board.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide DensElement™ Barrier System as manufactured by Georgia-Pacific Gypsum LLC.; or a comparable product by one of the following:
      USG Corporation and Tremco; Securock ExoAir 430 System.
      NO SUBSTITUTIONS.
   2. Board Thickness: 5/8 inch thick.
   3. Board Type: Type X.
   4. Board Size: 48 by 96 inches for vertical and horizontal installations.
   5. Air- and water-resistive Flashing Thickness: Minimum 16 mils wet film thickness.
   6. Physical and Performance Properties:
      a. Air Permeance; ASTM E 2178: Maximum 0.04 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference.
      b. Water Vapor Permeance: Minimum 10 perms (580 ng/Pa x s x sq. m) when tested according to ASTM E 96/E 96M, Procedure B.
      c. Combustion Characteristics; ASTM E 84: Class A.
      d. Board Product Antifungal Properties; ASTM D 3273: 10; zero defacement.
      e. VOC Content - Fluid-Applied Flashing: 50 g/L or less.
      f. UV and Weathering Resistance: Maximum 12-month exposure.

2.4 AIR BARRIER ACCESSORY MATERIALS

A. General: Provide compatible air barrier accessory materials furnished or recommended by air barrier manufacturer as required by Project conditions to produce a complete air barrier assembly identical to tested assemblies meeting performance requirements.

B. Joint Backing: See SECTION 07 92 00 - JOINT SEALANTS for backing materials.

C. Primer: Liquid primer recommended by air barrier manufacturer for exposed gypsum core edges.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide PROSOCO, Inc.; PorousPrep Sealer.
   2. Color: Blue.

D. Fluid-Applied Air Barrier Flashing: Site-applied for application to joints, fasteners, penetrations, openings and material transitions.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide DensDefy Liquid Flashing as manufactured by Georgia Pacific Gypsum LLC.
   2. Color: Gold

E. Flashing and Transition Strip: Self-adhered membrane, 25 mils thick.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide DensDefy Transition Membrane as manufactured by Georgia Pacific.

2.5 FASTENERS

A. Screws for Fastening Board Product Air barriers to Cold-Formed Metal Framing: Steel drill screws, ASTM C 1002, in length recommended by sheathing manufacturer for sheathing thickness.

B. Screws for Fastening Board Product Air Barriers to Wood Framing: Wood screws, ASTM C 1002, in length in accordance with sheathing manufacturer's written instructions for sheathing thickness.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Framing Examination: Examine framing to determine if work is ready to receive board product air barriers.
   1. Verify that surface flatness tolerances and framing spacing comply with Project requirements.
   2. Verify that adequate support is provided for sheathing board edges.
   3. Proceed with work once conditions comply with manufacturer's written instructions.

B. Adjacent Substrate Examination: Prior to installation of accessory materials, examine adjacent substrates to receive transition treatment.
   1. Verify that substrates are sound and free of contaminants, adequately cured or aged, compatible with proposed transition materials, and free of obstructions or impediments that would result in failure of transition adhesion and failure of air barrier assembly to perform according to Project requirements.
   2. Verify that concrete and masonry surfaces are visibly dry, cured, and free from release agents, curing agents, and other contaminates.
      a. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
   3. Verify that masonry joints are filled with mortar and struck flush.

C. Proceed with installation once conditions comply with manufacturer's written instructions and only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat portions of work not requiring sheathing board substrate according to air barrier manufacturer's written instructions.
   1. Mask adjacent finished surfaces.
   2. Remove contaminants and film-forming coatings from substrates.
   3. Remove projections and excess materials; fill voids with substrate patching material.
   4. Prepare and treat joints and cracks in substrate according to air barrier manufacturer's written instructions.

B. Joints:
   1. Seal all sheathing joints with fluid-applied flashing approved by sheathing manufacturer.
   2. Fill gaps from 1/8 to 1/4 inch with a backer rod prior to applying fluid-applied flashing.
   3. Seal gaps greater than 1/4 inch with transition membrane and fluid-applied flashing approved by sheathing manufacturer.

3.3 INSTALLATION OF AIR- AND WATER-RESISTIVE SHEATHING BOARDS

A. Discard each air- and water-resistive sheathing board with damage that compromises continuity or impairs performance as an air barrier, and is unable to be repaired according to manufacturer's written repair instructions.
   1. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

B. Comply with ASTM C 1280, GA-253, and manufacturer's written instructions.
   1. Fasten sheathing boards to cold-formed metal framing with specified screws in pattern indicated.
   2. Install sheathing boards with a 1/4-inch gap where they abut masonry or similar materials that might retain and transmit moisture to them.

C. Cut sheathing boards at penetrations, edges, and other obstructions of work to allow for application of air barrier accessory materials. Fit sheathing boards closely against abutting construction.

D. Install sheathing boards with long dimension perpendicular or parallel to framing. Abut ends and edges of sheathing boards centered over face of framing members. Offset sheathing boards joints by not less than one stud spacing.
   1. Apply sheathing boards in pieces sized to provide minimum number of joints and optimum sheathing board arrangement. Arrange joints so that pieces do not span between fewer than three support members.
   2. Do not bridge building expansion joints; cut and space edges of sheathing boards to match spacing of structural support elements.

E. Space fasteners maximum 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of sheathing boards and as required in indicated fire-resistance-rated designs.
   1. Apply fasteners so heads are seated flush to board product air barrier membrane surface without breaking or punching through the surface.
      a. Treat all fasteners with specified fluid-applied flashing used for sealing joints.
      b. Misplaced fasteners shall be left in place and treated. If fasteners must be removed, patch and treat resulting hole per system manufacturer’s written instructions.
   2. Securely attach sheathing boards to substrate by fastening as indicated, complying with the following:
      a. Table 2304.9.1, "Fastening Schedule," in the IBC.
      b. ICC-ES evaluation report for fastener.
   3. Use corrosion resistant sheet metal screw fasteners. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections.

F. Coordinate wall sheathing boards installation with flashing and air barrier accessory material installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

3.4 INSTALLATION OF SITE FLUID-APPLIED AIR BARRIER FLASHING

A. General: Apply site fluid-applied AB at joints, fasteners, penetrations, openings, and material transitions to achieve a continuous air barrier according to air barrier manufacturer's written instructions. Apply site fluid-applied AB within manufacturer's recommended application temperature ranges.

B. Apply self-adhered flashing material in full contact with substrate to produce a continuous seal according to air barrier manufacturers written instructions.
   1. Vapor-Permeable Air barrier: Total wet film thickness as recommended in writing by manufacturer to meet performance requirements, but not less than 16 mils wet film thickness, applied in one or more equal coats by roller, spray, trowel, or knife.

C. Do not cover air barrier until it has been tested and inspected by Owner's testing agency.

D. Do not cover air barrier until it has been inspected and approved by the Authority Having Jurisdiction for compliance with the applicable IBC and IECC. Components and systems subject to inspections include, but are not necessarily limited to, the following:
   1. Inspections at framing and rough-in shall be made before application of exterior and interior finishes and shall verify compliance with the code as to air leakage controls.

E. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air barrier components.

3.5 INSTALLATION OF AIR BARRIER ACCESSORY MATERIALS

A. General: Install accessory materials according to air barrier manufacturer's written instructions and AAMA 714. Install AB to adjacent components of building air barrier system, including, but not limited to, roofing system air barrier, exterior fenestration systems, door framing, and other openings.

B. Apply primer according to manufacturer's written installation instructions.

C. Seal punctures, voids, and seams. Patch with fluid-applied flashing extending 6 inches beyond repaired areas.

D. Seal wall penetrations according to manufacturer's written installation instructions and recommendations.

E. Connect and seal exterior wall air barrier continuously to subsequently-installed roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

F. Rough Openings: Apply bead of fluid-applied flashing to inside corners first, followed by application to jambs, header, sill, and adjacent sheathing.

G. Flashings: Seal top of through-wall flashings to air barrier with fluid-applied flashing.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections.
   1. Inspections: ABs, accessories, and installation are subject to inspection for compliance with requirements and photograph documentation of conditions to be concealed by subsequent Work.

B. Tests: As determined by Owner's testing agency from among the following tests:
   1. Qualitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 1186, smoke pencil with pressurization or depressurization or ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
   2. Quantitative Air-Leakage Testing: Test air barrier assemblies for air leakage according to ASTM E 783.

C. Air- and water-resistive sheathing board will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 CLEANING AND PROTECTING

A. Clean spills, stains, and overspray resulting application using cleaning agents recommended by manufacturers of affected construction. Remove masking materials.

B. Protect air barrier from damage from subsequent work. Protect materials from exposure to UV light for period in excess of that acceptable to air barrier manufacturer; replace overexposed materials and retest.

END OF SECTION

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SECTION 07 21 00

BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thermal, acoustical, and fire safing building insulations.

B. Related Sections:
1. Section 04 20 00 - Masonry Units.
2. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
3. Section 07 27 26 - Fluid-Applied Membrane Air Barriers
4. Section 07 41 20 - Prefinished Metal Roof Panels; roof insulation
5. Section 07 55 52 - Modified Bituminous Membrane Roofing; roof insulation
6. Section 07 65 00 - Flexible Flashing
7. Section 07 84 00 - Firestopping.

1.2 SUBMITTALS

A. General: Submit following items under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Including performance specifications, composition and applicable standards.

C. Samples: Submit 12" x 12" size samples of each type insulation proposed for use.

D. Manufacturer's Instructions: Written installation instructions, including attachment recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: (See Articles below for specific products)
CertainTeed Architectural
Dow Chemical Company
Johns Manville, A Berkshire Hathaway Co., Denver, CO
Knauf Insulation
Owens Corning, Toledo, OH
Rockwool
Thermafiber, Inc. (Owens Corning)
U.S. Gypsum Co.

2.2 BATT THERMAL INSULATION

A. Glass fiber composition, unfaced, minimum one lb./c.f. density, meeting following standards:
1. ASTM E 84: FHC 25/50 maximum.
2. ASTM C 518: R value of 3.2 per inch of thickness.
3. ASTM C 665: Type I and Type III, Class A.

B. Following products are acceptable:
1. Unfaced Thermal Batts by Owens Corning Fiberglas Corp.
2. Unfaced Building Insulation by CertainTeed Architectural
3. Unfaced Building Insulation by Johns Manville Corp.
4. Unfaced EcoBatt Insulation by Knauf Insulation

2.3 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
1. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
2. Smoke-Developed Index: Not more than 50 when tested in accordance with ASTM E84.

3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

B. Following products are acceptable:
1. TempControl Mineral Wool Batts; Johns Manville Corp.
2. Thermafiber Ultrabatt Mineral Wool Insulation; Owens Corning

2.4 SEMI-RIGID INSULATION

A. Continuous Insulation Basis of Design: Provide Thermafiber RainBarrier 45 Insulation as manufactured by Thermafiber, Inc., Wabash, IN (phone: 888-834-2371; web: www.thermafiber.com (an Owens Corning company)
1. Acceptable Products/Manufacturers:
JM CladStone 45 Water & Fire Block; Johns Manville
Cavityrock; Rockwool
Thermafiber RainBarrier 45; Owens Corning (Thermafiber Inc.)
2. Description: Non-combustible, semi-rigid mineral wool insulation board that is water repellent and resists temperatures above 2,000° F, meets ASTM C 612, IVA**.**
3. Thickness: As noted on contract drawings.
4. Paint flat black behind joints at open joint panel assemblies.
5. Type:
a. R-value of min. 4.2 per inch.
b. Facing: Unfaced.
c. Density: 4.5 pcf.
d. Surface Burning Characteristics: Unfaced-Flame Spread 0 and Smoke Developed 0
e. Moisture Resistance: Absorbs less than 0.03% by volume, ASTM C 1104.
f. Non-corrosive, ASTM C 665.
g. Recycled Content for Standard Mineral Wool Products.....…70%

2.5 BATT ACOUSTICAL INSULATION

A. Unfaced glass fiber composition, 3½" thick, minimum one lb./c.f. density, meeting following standards:
1. ASTM E 84: FHC 25/50 maximum.
2. ASTM C 518: R value of 3.2 per inch of thickness.
3. ASTM C 665: Type I, Class A.

B. Following products are acceptable
1. Sound Control Batts by CertainTeed Architectural
2. EcoTouch Sonobatts by Owens Corning Insulating Systems, LLC
3. Unfaced Building Insulation by Johns Manville Corp.
4. EcoBatt Insulation by Knauf Insulation

2.6 FIRE SAFING INSULATION

A. Mineral fiber composition, 4" thick, 4.0 pcf density, meeting following standards
1. ASTM E 84: FHC 15/10 maximum.
2. ASTM C 665: Type I, Class A
3. ASTM E 119: Testing Procedures.
4. FS HH-I-558B: Class 1 and 2.

B. Following products are acceptable
1. Thermafiber Safing Insulation by Owens Corning.
2. Mineral Wool Safing Insulation by Johns Manville.

2.7 ACCESSORIES

A. Joint Tape: Pressure sensitive type, recommended by insulation manufacturer.

B. Insulation Adhesive: Type recommended by insulation manufacturer.

C. Stick Clips
1. Galvanized sheet metal with impaling pins and retainer washers.
2. Size and type to suit application and insulation thickness.
3. Approved by manufacturer of insulation for intended use.

D. Stick Clip Adhesive
   1. High strength, resilient adhesive, having drying time of 0 to 30 minutes (rapid initial set), and 24 hours final set.
   2. Compatible with insulation adhesive, insulation and substrate.
   3. Non-corrosive to galvanized steel.

E. Supportive Wire Mesh: Hexagonal design, woven mesh "chicken wire" style.

F. Tie wire: Minimum 18 ga. annealed wire.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive insulation for conditions that will adversely affect the execution and quality of the work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Fit insulation tight within stud spaces, above soffits, behind fascias, and tight to and behind mechanical and electric services within plane of insulation, leaving no gaps or voids. Butt insulation tightly. Cut and fit tightly around items penetrating insulation. Stagger and butt joints, or cavity of a cavity wall system.

B. Install in conformance with the manufacturer's recommendations. Cut material to fit closely around obstructions and projections.
   1. Walls: Secure insulation by mechanical means to hold it in place without sagging or slumping. Install insulation with edges and joints butted tight to leave no gaps.
   2. Soffits: Insulation shall be laid between wire hangers on back of cement plaster and over cross runners. Sides and ends of adjacent batts shall be tightly butted together.
   3. Acoustical Insulation:
      a. Install acoustical insulation between the studs in those gypsum drywall partitions so detailed and noted on the drawings. Staple blankets to the gypsum board or otherwise fasten in place as recommended by the manufacturer of the blankets. Fill all voids.
      b. Where indicated at suspended gypsum board ceilings, lay sound attenuation blankets between wire hangers on back of gypsum board and over cross runners. Do not install on top of or within 3" of light fixtures.

C. Applying Semi-Rigid Insulation: Install board insulation between the wythes in exterior masonry walls.
   1. In masonry walls place boards over the fluid-applied membrane air barrier on the face of the backup masonry before the face brick wythe is laid.
   2. Securely fasten the board to the backup with mastic and suitable mechanical anchors to hold it firmly in place.
   3. In framed construction, apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
   4. Cut the material to fit snugly around obstructions and projections. Joints shall be tight.
   5. Seal joints between units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

D. Safing Insulation: Compress and install insulation on wire hangers or clips in spaces between floor slabs and curtain walls. Also, in openings in floor slabs to seal around telephone cables, piping, ducts and other utilities per SECTION 07 84 00 - FIRESTOPPING.

E. Curtain Wall Insulation: Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
   1. Foil face shall face interior of building.
   2. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass.
   3. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
   4. Install insulation to fit snugly without bowing.

3.3 SCHEDULES

A. Provide R values for thermal insulation as indicated on the drawings.

B. Provide acoustical insulation in thickness and locations as follows:
   1. Walls: 3½" (or as shown on drawings)
   2. Above Ceilings: 3½" (or as shown on drawings)

END OF SECTION

SECTION 07 26 00

VAPOR RETARDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vapor retarder placed on soil surface.

B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete.
2. Section 31 31 00 - Soil Treatment: Temporary polyethylene sheeting over treated soil.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. Provide product data for each type of product.
2. Manufacturer's installation instructions for placement, seaming, penetration prevention and repair, and perimeter seal per ASTM E1643.
3. Product Test Reports: For each product, for tests performed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Vapor Retarder: Product/manufacturer; one of the following:
Ecoshield-E; Epro Services
Stego Wrap (15 mil) Vapor Barrier; Stego Industries, LLC
Xtreme (15 mil) Vapor Barrier; Tex-Trude, LP
Perminator (15 mil); W.R. Meadows
1. Vapor Retarder membrane shall have the following qualities:
a. Permeance of less than 0.01 Perms [grains/(ft2*hr*inHg)] as tested after mandatory conditioning tests ASTM E 154 (sections 8, 11, 12, 13) per ASTM F 1249 or ASTM E 96.
b. ASTM E 1745 Class A.
c. Minimum thickness 15 mils.
2. Accessories:
a. Seam Tape: High-density polyethylene tape with pressure sensitive adhesive. Minimum width 4 inches.
b. Pipe Boots (Penetrations of Vapor Barrier): Construct pipe boots from vapor barrier material and pressure sensitive tape per manufacturer's instructions.
c. Perimeter/edge seal: Provide the following as manufactured by Stego Industries LLC, (887) 464-7834 www.stegoindustries.com.
1) Stego Crete Claw
2) Stego Term Bar.
3) StegoTack Double-Sided Tape.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by Architect and/or geotechnical engineer.

3.2 INSTALLATION

A. Install vapor retarder in accordance with manufacturer's instructions and ASTM E 1643.

B. Unroll vapor retarder with the longest dimension parallel with the direction of the concrete pour.

C. Extend vapor retarder to the perimeter of the slab. If practicable, terminate it at the top of the slab, otherwise (a) at a point acceptable to the structural engineer or (b) where obstructed by impediments, such as dowels, waterstops, or any other site condition requiring early termination of the vapor barrier. At the point of termination, seal vapor barrier to the slab itself using perimeter/edge seal, such as Stego Crete Claw or termination bar and tape per manufacturer's instructions.

D. Overlap joints a minimum of 6" and seal with manufacturer’s seam tape.

E. Seal all penetrations (including pipes) with manufacturer’s pipe boot.

F. Turn edge of sheeting down face of perimeter grade beam a minimum of 6".

G. Use reinforcing bar supports with base sections that eliminate or minimize the potential for puncture of the vapor barrier.

H. Repair damaged areas by cutting patches of vapor retarder, overlapping damaged area 6" and taping all four sides with tape.

END OF SECTION

SECTION 07 27 26

FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Vapor-permeable, fluid-applied air barriers, which also function as water-resistive barriers.

B. Related Requirements:
1. Section 01 45 00 - Quality Control: for general mockup requirements.
2. Section 01 45 23 - Testing and Inspection Services: for coordination with testing agency.
3. Section 03 11 19 - Insulating Concrete Forming.
4. Section 04 20 00 - Masonry Units; concrete unit masonry treatment.
5. Section 06 16 56 - Air and Water-Resistive Sheathing Board System: for vapor-permeable air- and water-resistive wall sheathing and associated site-fluid-applied air barrier flashing.

1.2 DEFINITIONS

A. Air-Barrier Material (AB): A primary element that provides a continuous barrier to the movement of air.

B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

D. Water-Resistive Barrier (WRB): Water-shedding barrier made of material that is moisture-resistant, and installed to shed water, with sealed joints and penetrations, and with terminations sealed to adjacent surfaces.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.
1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.
4. Consult air barrier manufacturer for additional installation guidelines and illustrations to assist with meeting shop drawing requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.
1. Certification shall include statement that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.
2. Certification shall include statement that cleaning materials used during installation are chemically compatible with adjacent materials proposed for use.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
   1. Installer(s) shall be certified by BPQI (Building Performance Quality Institute) for the ABAA Quality Assurance Program in accordance with the requirements outlined in the QAP program used by ABAA. Installers shall have their photo identification air barrier certification cards in their possession and available on the project site, for inspection upon request.

B. Mockups: Build mockups to set quality standards for materials and execution and for preconstruction testing.
   1. Build integrated mockups of exterior wall assembly as indicated on Drawings, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
      a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
      b. Include junction with roofing membrane**,** building corner condition, and foundation wall intersection.
      c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Owner will engage a qualified testing agency to perform preconstruction testing on field mockups.

B. Mockup Testing: Air-barrier assemblies shall comply with performance requirements indicated, as evidenced by reports based on mockup testing by a qualified testing agency.
   1. Air-Leakage-Location Testing: Mockups will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
   2. Air-Leakage-Volume Testing: Mockups will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
   3. Water Penetration Testing: Mockups will be tested for water penetration according to ASTM E 1105.
   4. Adhesion Testing: Mockups will be tested for required air-barrier adhesion to substrate according to ASTM D 4541 (modified).
      a. Use a type II pull tester, except that the membrane shall be cut through to separate the material attached to the disc from the surrounding material.
      b. Perform test after curing period recommended by the material manufacturer.
      c. Record mode of failure and area where the material failed in accordance with ASTM D4541.
      d. The inspection report shall indicate whether the specified adhesion requirement has been met.
   5. Compatibility Determinations: Mockups will be inspected for visual signs of decay, chemical attack, or degradation of any kind. Suspect instances shall be reported to the corresponding manufacturer who shall provide a letter that approves moving forward with the project or rejects the use of the product or rejects the method or circumstances of installation with an appropriate explanation of the position taken.
   6. Notify Architect seven days in advance of the dates and times when mockups will be tested.
   7. Perform the air leakage test and water penetration test of mockups prior to installation of cladding and trim but after installation of all fasteners for cladding and trim, and after installation of other penetrating elements.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

C. Deliver materials to Project site in original packages with seals unbroken, labeled with material Manufacturer's name, product, date of manufacture, and directions for storage.

D. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by material manufacturer.

E. Handle materials in accordance with material manufacturer's recommendations.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

B. Sequencing. Do not install air barrier material before the roof assembly has been sufficiently installed to prevent a buildup of water in the interior of the building.

C. Compatibility. Do not allow air barrier materials to come in contact with chemically incompatible materials.

D. Ultra-violet Exposure. Do not expose air barrier materials to sunlight longer than as recommended by the material manufacturer.

1.10 WARRANTY

A. Manufacturer's Warranty: Manufacturer's standard form in which air barrier manufacturer agrees to furnish and install air barrier material to repair or replace those materials installed according to manufacturer's written instructions that exhibit material defects or otherwise fail to perform as specified under normal use within warranty period specified.
   1. Manufacturer's Warranty Period: Five (5) years from Date of Substantial Completion.

B. Installer's Warranty: Provide installer's installation warranty, including all accessories and materials of the air barrier assembly, against failures including loss of airtight seal, loss of watertight seal, loss of attachment, loss of adhesion and failure to cure properly.
   1. Installer's Warranty Period: Two (2) years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.
   1. If the materials in this section are adjacent to the materials specified in Section 06 16 56 Air- and Water-Resistive Sheathing Board System, all materials in this section shall be compatible with the materials and products specified in that section and shall be approved by the air- and water-resistive sheathing board system manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft., when tested according to ASTM E 2357.

2.3 MEDIUM-BUILD AIR BARRIERS, VAPOR PERMEABLE

A. Medium-Build, Vapor-Permeable Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide Prosoco, Inc.; R-Guard Cat 5 (at medium-build thickness) or a comparable silyl-terminated polyether (STPE) product by one of the following:
      Tremco, Inc.
      3M Industrial Adhesives and Tapes Division.
      DuPont Safety & Construction.
      GE Construction Sealants; Momentive Performance Materials Inc.
      Hohmann & Barnard, Inc.
      W.R. Meadows, Inc.
   2. Physical and Performance Properties:
      a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. pressure difference; ASTM E 2178.
      b. Vapor Permeance: Minimum 10 perms; ASTM E 96/E 96M, Desiccant Method, Procedure A.
      c. Ultimate Elongation: Minimum 250 percent; ASTM D 412, Die C.
      d. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested according to ASTM D 4541.
      e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
      f. UV Resistance: Can be exposed to sunlight for 120 days according to manufacturer's written instructions.
      g. Fastener Sealability: No water infiltration when tested in accordance with ASTM D 1970.

2.4 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

B. Primer: Liquid waterborne primer recommended for substrate by air-barrier material manufacturer.

C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch thick, and Series 300 stainless-steel fasteners.

D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Corning Corporation.
      b. GE Construction Sealants; Momentive Performance Materials Inc.
      c. Pecora Corporation.
      d. Prosoco, Inc.
      e. Tremco Incorporated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
   3. Verify that substrates are visibly dry and free of moisture. Test concrete substrates for capillary moisture by plastic sheet method according to ASTM D 4263.
   4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

3.3 ACCESSORIES INSTALLATION

A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
   1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
   2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
   3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.

C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.

D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches of coverage is achieved over each substrate. Maintain 3 inches of full contact over firm bearing to perimeter frames, with not less than 1 inch of full contact.
   1. Transition Strip: Roll firmly to enhance adhesion.

F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.

G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

H. Seal top of through-wall flashings to air barrier with an additional 6-inch-wide, transition strip.

I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.

J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches beyond repaired areas in strip direction.

3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
   3. Where multiple prime coats are needed to achieve required bond or thickness, allow adequate drying time between coats.

B. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
   1. Vapor-Permeable, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 17 mils, applied in two equal coats. Apply additional material as needed to achieve void- and pinhole-free surface, but do not exceed thickness on which required vapor permeability is based.
      a. Second coat shall be back rolled in accordance with manufacturer’s written instructions.

C. Do not cover air barrier until it has been tested and inspected by testing agency.

D. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
   1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
   2. Air-barrier dry film thickness.
   3. Continuous structural support of air-barrier system has been provided.
   4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
   5. Site conditions for application temperature and dryness of substrates have been maintained.
   6. Maximum exposure time of materials to UV deterioration has not been exceeded.
   7. Surfaces have been primed, if applicable.
   8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
   9. Termination mastic has been applied on cut edges.
   10. Strips and transition strips have been firmly adhered to substrate.
   11. Compatible materials have been used.
   12. Transitions at changes in direction and structural support at gaps have been provided.
   13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
   14. All penetrations have been sealed.

C. Tests: As determined by testing agency from among the following tests:
   1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
   2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783 or ASTM E 2357.
   3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. of installed air barrier or part thereof.

D. Air barriers will be considered defective if they do not pass tests and inspections.
   1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
   2. Remove and replace deficient air-barrier components for retesting as specified above.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

C. Remove masking materials after installation.

END OF SECTION

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SECTION 07 41 20

PREFINISHED METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefinished metal roof panels and soffit panels including related underlayment's, flashing, trim and accessories.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry.
2. Section 07 62 00 - Sheet Metal Flashing and Trim.
3. Section 07 92 00 - Joint Sealants.

1.2 SYSTEM REQUIREMENTS

A. Performance Requirements
1. Uplift resistance: UL Class 90 wind uplift resistance.
2. Design and install system to accommodate thermal expansion, thermal contraction and building movement.

1.3 SUBMITTALS

A. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Shop Drawings: Drawings shall indicate type of roof panels, gage of metal, finish and shape and size of flashing and accessories.

C. Product Data: Submit manufacturer's technical literature indicating properties of materials, finishes and performance capabilities.

D. Samples
1. Submit 2' x 4' section of roof panel system, complete with flashings and attachment devices.
2. Upon selection of colors by Architect, submit 12" x 12" finish samples representing color and finish.
3. Submit 6" x 6" sample of self-adhering sheet underlayment.

E. Color Charts: Submit samples of manufacturer's full range of standard colors. Submit actual color chips, not photo reproductions.

F. Qualification Data
1. Submit installer qualifications verifying years of experience; include list of completed projects having similar scope of work identified by name, location, date, reference name and phone number.
2. Submit letter certifying manufacturer's approval for installation of system.
3. On-site or field manufactured panels are not acceptable, unless approved in writing. Field curving of pre-manufactured panels is acceptable. If on site roll-forming is approved, submit documentation on roll-forming equipment which will be used to roll-form roofing panels on site. Provide copy of UL certificate, including certification report identifying Make and Model No., Serial No. of roll-forming machine, panel specification and expiration date of certificate.

G. Manufacturer's Instructions: Submit written installation instructions indicating method and sequence of installation. Provide for roofing system and self-adhering sheet underlayment.

H. Warranty: Submit signed and dated copies of warranties.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: This work shall be performed by an experienced applicator who has successfully installed the materials under similar conditions over a period of at least 10 years.

B. Cover self-adhering sheet underlayment within 14 days of underlayment installation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver preformed metal roof panels and trim items to the project site with no dents, scratches, or abraded areas. Deliver in manufacturer's standard bundles, securely bound and store at the project site raised above slab or ground level on pallets.

1.6 WARRANTY

A. Submit manufacturer's standard 20-year warranty against fading or visible (noticeable) chalking, checking, crazing or peeling of the exterior finish when exposed to natural sunlight for a period of 20 years.

B. Submit manufacturer's 20-year “No-Dollar-Limit” Complete System panel and trim weathertightness warranty.

C. Submit applicator's 2-year weathertightness warranty.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Roof Panels: Basis of Design shall be Tite-Loc Plus as manufactured by Peterson Aluminum Corp. Metal panels shall be zinc coated steel complying with ASTM A 653, Grade A; with ASTM A 653 G90 hot-dip coating, 24 gage minimum thickness, with striations, for roof panels. Seam spacing shall be 12" to 16" o.c. with all panels having the same spacing. Panels shall be single pieces with no horizontal joints. Provide one of the following:
MBCI; SuperLok
Peterson Aluminum Corp.; Tite-Loc Plus

B. Soffit Panels: Basis of Design shall be Flush Panel as manufactured by Petersen Aluminum. Panels shall be 12" wide with concealed anchors. Provide venting strips where needed. Panels shall be 22 gauge minimum thickness. Provide one of the following:
MBCI
Peterson Aluminum Corp.

C. Finish: Metal roof and soffit panels, and all exposed trim items, shall receive fluorocarbon polymeric coating containing 70% PVDF Hylar 5000 or Kynar 500 finish. Color shall be as scheduled in MATERIAL FINISH SCHEDULE in the drawings.

D. Flashing and all trim items which are contiguous to roof panels shall be of the same metal and finish as roof panels.

E. Fasteners: Provide manufacturer's standard zinc coated self-tapping screws meeting UL 90 requirements.

F. Polyisocyanurate Insulation: Reinforced polyisocyanurate foam core faced both sides with non-asphaltic glass fibers chemically bonded in the manufacturing process.
1. Compressive Strength: 20 psi
2. Install in not less than 2 layers of 2.5” min. thickness per board to achieve Thermal Resistance (LTTR value) as designated in Building Envelope Assembly Type drawings.

G. Self-adhering Sheet Underlayment (High Temperature): 30 to 40 mils thick minimum, consisting of slip-resisting, polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
1. Thermal Stability: Stable after testing at 240 degrees F; ASTM D 1970.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F (29 deg C); ASTM D 1970.
3. Products: Subject to compliance with requirements, provide one of the following:
Carlisle Coatings & Waterproofing Inc., Div. of Carlisle Companies Inc.; CCW WIP 300HT.
Grace Construction Products; a unit of Grace, W. R. & Co.; Ultra.
Henry Company; Blueskin PE200 HT.
Metal-Fab Manufacturing, LLC; MetShield.

H. Mechanical Fasteners and Bearing Plates: Provide U.L. listed (standard) clip designed to allow panels to expand and contract. Steel deck fasteners shall be UL listed and shall be approved by roofing manufacturer for compliance with UL-90 uplift requirements.

I. Sealants and Gaskets: Manufacturer's standard type suitable for use with installation of metal roofing; non-staining; skinning, non-shrinking and non-sagging; ultra-violet and ozone resistant for exterior applications; colors to match exposed metal.

J. Internal and External Corners: Same materials, gage and finish as panels; profile to suit system; brake formed to required angles. Mitered internal corners, back braced with sheet stock, to maintain continuity of profile.

K. Expansion Joints: Same material and where exposed, finish as panels, manufacturer's standard type, of profile to suit system. Exposed fasteners same finish as panels.

L. Trim, Closure Pieces, Cap, Fascias, Infills, Flashings and Accessories: Same material, gage and where exposed, of same finish as metal panels, brake formed to required profiles.

M. Touch-Up Paint: As recommended by manufacturer.

2.2 FABRICATION

A. Comply with dimensions, profile, gages and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.

B. Fabricate components of the system at the factory, ready for field assembly.

C. Fabrication of component profiles on site not permitted.

D. Apply finish coatings prior to roll forming.

E. Fabricate continuous panels only. No field joints allowed.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine supporting members and areas to receive prefinished metal roof panels, flashing and trim items for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General: Install prefinished metal roof panels and related items in strict compliance with manufacturer's recommendations.

B. Self-adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at entire roof area, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Do not install underlayment perpendicular to roof slope except at locations specifically required for watertightness.
   1. Cover underlayment within 14 days. If underlayment cannot be covered within that time period, install an additional layer of underlayment as described above immediately prior to roof installation.
   2. Install underlayment in accordance with underlayment manufacturer’s written instructions.

C. Metal roofing installation shall be installed so that entire metal roof system meets UL Windstorm Resistance Classification 90 as indicated on the drawings.

D. Continuous full-length pans shall be fabricated by factory roll forming in power equipment capable of producing metal roofing pans to the required lengths. End laps are not allowed.

E. Anchor components parts of the prefinished roof panels securely in place, providing for necessary thermal and structural movement.

F. Install and securely anchor metal flashing, trim and related items to provide a weathertight enclosure.

G. Install trim, closures, caps and accessories as indicated or required for complete weathertight installation.

H. Provide a concealed fasteners installation system with no fasteners exposed on the exterior face of the work.

I. Seal prefinished roof panels as required for weathertightness.

J. Tolerances:
   1. Maximum Offset from True Alignment Between Adjacent Members Butting or in line: 1/16".
   2. Maximum Variation from Plane or Location Indicated on Drawings: 1/8”.

3.3 TOUCH-UP AND CLEAN

A. Touch-up:
   1. Defective materials shall be replaced with new materials.
   2. Field touch-up of scratches or defaced finish will be permitted only if approved by Architect.

B. Cleaning: Clean exposed surfaces; leave free of soil and imperfections.

END OF SECTION

SECTION 07 42 13

METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Preformed metal wall panels, including related flashing and trim at metal wall panels.

B. Related Sections:
1. 07 62 00 - Sheet Metal Flashing and Trim; to match metal wall panel colors.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Drawings shall indicate type of wall panels, gage of metal, finish, and shape and size of flashing and accessories.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: This work shall be performed by an experienced applicator who has successfully installed the materials under similar conditions over a period of at least 10 years.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver preformed metal wall panels and trim items to the project site with no dents, scratches, or abraded areas. Deliver in manufacturer's standard bundles, securely bound, and store at the project site raised above slab or ground level on pallets.

1.5 WARRANTY

A. Submit manufacturer's standard 20-year warranty against fading or visible (noticeable) chalking, checking, crazing or peeling of the exterior finish when exposed to natural sunlight for a period of 20 years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wall Panels at Press Boxes: Basis of Design shall be Box Rib 1 as manufactured by Petersen Aluminum. Panels shall be attached with concealed anchors. Panels shall be 24 gauge prefinished steel.

B. Soffit Panels: Basis of Design shall be Flush Panel as manufactured by Petersen Aluminum. Panels shall be 12" wide with concealed anchors. Provide venting strips where needed. Panels shall be 22 gauge minimum thickness. Provide one of the following:
MBCI
Peterson Aluminum Corp.

C. Finish:
1. Metal wall and soffit panels and all exposed trim items shall receive fluorocarbon polymeric coating containing 70% Kynar 500 or Hylar 5000 finish with a dry film thickness of 0.7 to 0.8 mil exclusive of the primer. Color shall be as scheduled in MATERIAL FINISH SCHEDULE in the drawings.

D. Flashing, gutters, downspouts, and all trim items which are contiguous to wall panels shall be of the same metal and finish as wall panels.

E. Fasteners: Screws holding anchor clips to the structure shall be stainless steel cadmium plated self-tapping screws into predrilled holes.
1. Exposed fasteners shall match the finish of the panel system and shall be aluminum or stainless steel with separate washers with hot-bonded neoprene faces; pop rivets are not acceptable.

F. Building Paper: ASTM D 226, No. 30 asphalt saturated organic felt.

G. Sealant:
   1. Concealed Sealant: Non-curing, non-skinning butyl, polyisobutylene or polybutane tape of sufficient thickness to make full contact with both surfaces.
   2. Exposed Sealant: Curing type, manufacturer's standard. Color shall be as selected by Architect.

2.2 FABRICATION

A. Comply with dimensions, profile, gages, and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine supporting members and areas to receive preformed metal wall panels, flashing, and trim items for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General: Install preformed metal wall panels and related items in strict compliance with manufacturer's recommendations.

B. Full length pans shall be fabricated by roll forming in power equipment capable of producing metal wall pans to the required lengths.

C. Anchor components parts of the preformed wall panels securely in place, providing for necessary thermal and structural movement.

D. Install and securely anchor metal flashing, trim and related items to provide a weathertight enclosure.

E. Provide a concealed fasteners installation system with no fasteners exposed on the exterior face of the work.

F. Seal preformed panels as required for weathertightness.

G. When used in windscreen or fence location, panels must be fastened (stitched) through side joints.

3.3 TOUCH-UP AND CLEAN

A. Touch-up:
   1. Defective materials shall be replaced with new materials.
   2. Field touch-up of scratches or defaced finish will be permitted only if approved by Architect.

B. Cleaning: Clean exposed surfaces; leave free of soil and imperfections.

END OF SECTION

SECTION 07 48 00

RAINSCREEN ATTACHMENT SYSTEM (MFI)

PART 1 - GENERAL

1.1 SUMMARY

A. Provide a thermally broken, rainscreen attachment system for attachment of exterior cladding including metal wall panels, preformed siding, fiber cement siding and wall panels, aluminum faced composite panel system and stucco assemblies installed over exterior mineral fiber insulation.

B. Related Sections:
1. Section 01 45 00 - Quality Control: for general mockup requirements.
2. Section 05 40 00 - Cold-formed Metal Framing: for cold-formed steel exterior wall studs and furring.
3. Section 06 16 56 - Air and Water-Resistive Sheathing Board System: for vapor-permeable air- and water-resistive wall sheathing and associated site-fluid-applied air barrier flashing.
4. Section 07 21 00 - Building Insulation: for mineral wool board insulation.
5. Section 07 27 26 - Fluid-Applied Membrane Air Barriers: for vapor-permeable fluid-applied air barriers, which also function as water-resistive barriers.
6. Section 07 46 50 - Aluminum Faced Composite Panel System.
7. Section 07 21 00 - Building Insulation: for mineral wool board insulation.
8. Section 09 21 16 - Gypsum Board Assemblies: for glass-mat gypsum wall sheathing and wall sheathing joint and penetration treatments.

1.2 SYSTEM DESCRIPTION

A. System assembly shall include the following components from the substrate out:
1. Substrate: Wall framing assembly and sheathing, concrete masonry unit wall, or concrete wall.
2. Weather Resistant/Air Barrier over substrate.
3. Mineral fiber insulation (mineral wool board insulation).
4. Thermally broken rainscreen attachment system.
5. Exterior cladding.

B. Design Requirements:
1. Manufacturer is responsible for designing system, including anchorage to structural system and necessary modifications to meet specified requirements and maintain visual design concepts.
2. Employ registered professional engineer, licensed to practice engineering in jurisdiction where Project is located, to engineer each component of rainscreen attachment system.
3. Structural Design: Exterior-insulated rainscreen wall assembly capable of withstanding effects of load and stresses from dead loads, wind loads, ice loads (if applicable) as indicated on Structural General Notes on Structural Drawings, and normal thermal movement without evidence of permanent defects of assemblies or components.
    a. Thermal Movements: Provide assemblies that allow for thermal movements resulting from the following maximum ambient temperatures by preventing overstressing of components and other detrimental effects:
        1) Temperature Change (range): 120 degrees Fahrenheit, ambient:
4. Support Framing/Attachment System:
    a. Frequency and spacing of brackets as indicated by manufacture in project specific engineering package.

C. Performance Requirements:
1. Structural Performance:
    a. Framing Members:
        1) Test framing components to AAMA TIR- A8-[04] – Section 7.2 to determine structural performance and effective moment of inertia for each perforated component. Minimum Effective Moment of Inertia for Primary Rail: 0.0134 in4.
        2) Localized bending stress for eccentrically loaded framing members must be evaluated with the maximum effective length of resisting element not more than 12 inches.
    b. Fasteners:
        1) Tension shall be taken as sum of direct tension plus tension due to prying for eccentrically loaded connections. Prying may be reduced or eliminated if proven via engineering analysis or testing.
        2) Minimum Safety Factor of 3 for both tension and shear values.

3) Combined tension and shear shall be evaluated according to an interaction formula. Sum of terms shall not exceed 1.0.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's product literature and descriptions of testing performed on system components to indicate meeting or exceeding specified performance.

B. Shop Drawings:
1. Submit connection details to the cladding manufacturer, showing interface of rainscreen attachment system to substrate and panels with adjacent construction, signed and sealed by Professional Engineer, licensed to practice engineering in jurisdiction where Project is located.
2. Show system installation and attachment, including fastener size and spacing.

C. Structural Calculations:
1. Submit rainscreen attachment manufacturer's comprehensive Structural Design analysis signed and sealed by a Professional Engineer, licensed to practice engineering in jurisdiction where Project is located.

D. Samples: Submit following material samples for verification:
1. Wall Brackets: Two (2) samples.
2. Horizontal and Vertical Rails: Two (2) 12-inch long samples.

E. Test Reports:
1. Test to the following standards and provide written test reports by a third party:
a. AAMA TIR-A8-**[04]**: Structural Performance of Composite Thermal Barrier Framing Systems – Section 7.2.
2. Comprehensive three-dimensional thermal modeling report indicating framing systems impact on exterior insulation rated R-value.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Minimum 5 years' experience specializing in the manufacturing of façade attachment/support framing similar to those specified.
2. Ability to demonstrate conformance to testing requirements.

B. Installer Qualifications:
1. Minimum of 3 years' documented experience or minimum of 5 completed projects of equivalent scope and quality and recommended by manufacturer to perform work of this Section.
2. Onsite superintendent or foreman overseeing installation on site during entire work of this Section with experience equivalent to installer and in good standing with the manufacturer.

C. Engineer Qualifications: Registered professional engineer experienced in the design of curtain wall systems, anchors, fasteners and licensed to practice engineering in the jurisdiction where Project is located.

D. Pre-Installation Meeting:
1. Discuss sequence and scheduling of work and interface with other trades.
2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
3. Review and document methods, procedures and manufacturer's installation guidelines and safety procedures for exterior wall assembly.

E. Mock-Ups: Coordinate mock-up materials and requirements with mock-up specified in Division 01 and exterior cladding specifications.

1.5 QUALITY CONTROL

A. Single source responsibility:
   1. Furnish engineered rainscreen attachment system components under direct responsibility of single manufacturer.

B. Field Measurements: Verify actual supporting and adjoining construction before fabrication.

C. Record field measurements on project record shop drawings.

D. Established Dimensions: Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of rainscreen attachment system corresponding to established dimensions.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials and components in manufacturers' original, unopened and undamaged containers or bundles, fully identified. Exercise care to avoid damage during unloading, storing and installation.

B. Store, protect and handle materials and components in accordance with manufacturer recommendations to prevent damage, contamination and deterioration. Keep materials clean, dry, and free of dirt and other foreign matter, and protect from damage due to weather or construction activities.

1.7 SEQUENCING

A. Ordering: Comply with manufacturers' ordering instructions and lead time requirements to avoid construction delays.

B. Coordinate construction to ensure that assemblies fit properly to supporting and adjoining construction; coordinate schedule with construction in progress to avoid delaying work.

1.8 WARRANTY

A. Manufacturer Warranties:
   1. Attachment System: Ten (10) year Limited Warranty.
      a. Covers components of the attachment system, including structural failure of components when all the materials and components are supplied and installed per manufacturer's requirements.
      b. Includes labor and material for removal and replacement of defective material.
      c. Includes labor to remove and reinstall façade finish panels, finish closures and façade finish accessories necessary to access defective material.

B. Contractor's Warranties: 2-year labor warranty, starting from date of Substantial Completion, to cover repair of materials found to be defective as a result of installation errors.

1.9 MAINTENANCE

A. Extra Materials: For use by Owner in building maintenance and repair, provide 3 percent additional rainscreen attachment components in new, unopened cartons, packaged with protective covering for storage and identified with appropriate labels.

PART 2 - PRODUCTS

2.1 RAINSCREEN ATTACHMENT/SUPPORT FRAMING SYSTEM

A. Comply with ANSI/ASHRAE 90.1-2013.

B. Coating Material: ASTM A1046, Zinc-Aluminum-Magnesium, minimum thickness ZM40.
   1. ASTM A653 Galvanized steel is not acceptable.

C. Steel Classification: Structural Steel (SS), Grade 50, 50 ksi Yield.

D. Spacing: Comply with manufacturer's Professional Engineer's project specific calculations.

E. Wall Brackets:
1. Basis of Design Product: ThermaBracket-S by Knight Wall Systems or approved equal.
2. Minimum 0.074 inch thick (14 gauge) sheet steel.
3. Dimensions:
a. Bracket Base: Minimum 3.125 inch high by 2.125 inch wide.
b. Offset Brackets: 2-inch or 3-inch depth, as indicated on drawings.
1) Align offsets to differing wall planes as shown on Drawings.
4. Pre-Punched Holes: Two wall anchors per bracket.

F. Primary Rail (horizontal or vertical per cladding requirements):
1. Basis of Design Product: S-Rail by Knight Wall Systems or approved equivalent.
2. Minimum 0.054-inch thick (16 gauge) cold-formed steel.
3. Profile: C channel, two flanges of equal length and one web.
4. Nominal Dimensions: Minimum 1.0 inch flange for attaching to wall bracket and 1.625 inch at web.
5. Pre-Punched Attachment Holes: 1.0 inch on center along length of track and oversized allowing for thermal contraction and expansion of rail without placing stress on brackets.
6. Finish: Painted flat black at open joint panel assemblies.

G. Thermal Isolation:
1. Material: Injection molded Polyoxymethylene copolymer (POM), non-fiber reinforced.
2. Tensile Yield Strength: 9.57 ksi per ISO 527.
3. Melting Temperature: 329 degrees Fahrenheit per ISO 3146.
4. Components:
a. Basis of Design Product: ThermaStop™ Isolators by Knight Wall Systems or approved equivalent.
b. Wall Anchor Isolation Washer: minimum 0.125 inch thick.
c. Support Wall Substrate Isolation: Minimum 0.375-inch thick at each wall bracket.
d. Rail to Bracket Isolation: Minimum 0.125 inch thick at each connection.
e. Bracket Shim: Match support wall substrate isolator profile; available in 0.125-inch thickness and does not decrease thermal or structural performance of system.

H. Fasteners:
1. Sufficient length to provide solid attachment to structure as required by manufacturer.
2. Thermally isolated.
3. Framed substrate with sheathing: Self-drill hex-washer-head stainless steel with 1,000 hour salt-spray rated thermoset polyester coating.
a. Embedment depth: 0.625 inches or three full threads minimum, whichever is greater.
b. Minimum ultimate pull-out capacity from 18 gauge steel: 450 pounds.
4. Concrete and concrete masonry units substrate:
a. Embedment depth: 1.25 inches minimum.
b. Minimum ultimate pull-out capacity from substrate material: 450 pounds.
c. Acceptable Products:
1) 1/4 inch Kwik-Con II+ by Hilti
2) 1/4 inch Tapcon by Buildex
3) 1/4 inch UltraCon by Elco Industries
4) Or approved equal.
5. For primary to secondary rail connection: Self-drill hex-washer-head stainless steel with 1,000 hour salt-spray rated thermoset polyester coating.
a. Embedment depth: 0.625 inches or three full threads minimum, whichever is greater.
b. Minimum ultimate pull-out capacity from 18 gauge steel: 450 pounds.

I. Accessories:
1. Bracing, Furring, Bridging, Plates, Gussets, and Clips: Formed sheet steel, thickness as necessary to meet structural requirements for special conditions encountered.
2. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar metals.

2.2 MINERAL FIBER INSULATION

A. Refer to Section 07 21 00 – Building Insulation.

2.3 SIDING/CLADDING PANEL

A. Refer to Division 07 for cladding materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with manufacturer requirements for installation conditions affecting performance of the work.
   1. Do not proceed with installation until unsatisfactory conditions have been corrected.
   2. Ensure air barrier/weather-resistant barrier (AB/WRB) is installed prior to installing rainscreen attachment system.
   3. Ensure fenestration, transitions, discontinuities, sills, and ledgers are flashed and sealed to move moisture to the exterior of the building.

B. Field verify architectural details and mechanical and electrical requirements prior to commencing installation.

C. Commencement of installation constitutes acceptance of existing conditions and acceptance of responsibility for satisfactory performance.

3.2 RAINSCREEN ATTACHMENT SYSTEM INSTALLATION

A. Preparation: Review areas of potential interference and conflicts and coordinate layout and support provisions for interfacing work.

B. Installation: Install in strict accordance with manufacturer's installation instructions.

C. Wall Brackets and Primary Rail:
   1. Mount wall brackets at 16-inches on center horizontally on support wall (at each stud location).
      a. Brackets must be laid out at 0.5 inch increments vertically or horizontally.
      b. Secure brackets with fasteners that are wet-set with sealant compatible with the air- and water-resistive barrier system. *****ADD THE FOLLOWING FOR HOUSTON PROJECTS***** After installation, apply sealant along top edge of brackets to shed water.
      c. Tighten screws to substructure to a snug tight condition and not stripped. Do not over-torque beyond manufacturer's recommendation. If installed using hand tools, verify for each installer at beginning of project using snug-tight criteria. Do not use stripped holes.
   2. Thermally isolate wall bracket attachments by sandwiching thermal break material between metal bracket and support wall substrate.
   3. Thermally isolate screw fastener washers using material to thermally isolate fastener heads from metal bracket.
   4. Mineral Fiber Insulation: Install to expand into and friction fit between wall brackets as specified by Section 07 21 00 prior to installing primary rails.
   5. Attach primary rail to wall bracket stem by use of a self-tapping screw fastener through the pre-punched holes in the rail and into the pre-punched pilot holes on the bracket.
   6. Isolate primary rail from bracket by sandwiching a thermal break material between rail and bracket stem.
   7. Attach primary rail at proper pre-punched pilot holes on bracket stem to align plumb and true. Account for irregularities in support wall.
   8. Establish and re-establish and restart vertical bracket locations using laser or chalk-line at fenestrations and other obstructions to establish horizontal alignments.

3.3 ERECTION TOLERANCES

A. Maximum Framing Member Variation from True Position: 1/4 inch.

B. Maximum Framing Member Variation from Plane:
   1. Individual Framing Members: Do not exceed 1/4 inch in 10 foot.
   2. Accumulative Over-all Variation for Wall and Floor System: Do not exceed 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Technical Service: Make intermittent and final inspection to verify installation in conformance to manufacturer instructions and suitable as framing assembly for subsequent metal panels, acrylic plastering, and other cladding installations.
   1. Confirm snug tight and fastener sizing.
   2. Confirm framing members installed in correct orientation.

3.5 ADJUSTING

A. Inspect and adjust after installation. Replace or repair defective work.

B. Adjust, and reconfigure as necessary to accommodate cladding systems for installations over work of this Section. Do not reuse pre-drilled holes unless fastener size is increased.

3.6 SIDING/CLADDING PANEL INSTALLATION

A. The cavity must be clear and free from air flow and drainage obstructions.

END OF SECTION

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

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)
   1. 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" with manufacturer proving to architect project has been registered.

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) handheld, "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 the observation and test, that 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 sheet 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, 138 MPH 3-second gust wind speed zone and risk category III based on IBC building code requirements.
    1. Zone 1 Field -45

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 sheet 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 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 flashings, 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. 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 Manufacturers:
1. Firestone Building Products Company now called Elevate-Holcim, Nashville, TN; (800) 428-4442
2. Johns Manville, Denver, CO; (800) 654-3103

2.2 ROOF MEMBRANE ASSEMBLY

A. System Description: A roof membrane assembly consisting of a nail Base/Anchor sheet into lightweight concrete followed by 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 mid-ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system. Mid-ply is to be installed utilizing hot asphalt and Cap-Ply by utilizing torched application. Provide components for the roof membrane assembly meeting the following physical and mechanical requirements.

1. Modified Base/Anchor Sheet: A fiberglass reinforced, Styrene-Butadiene-Styrene (SBS) modified asphalt coated sheet, having an average weight of 28 pounds per square.
a. Approved Product:
1) Firestone Product: MB Base, base sheet
2) JM Product: Perma Ply 28, base sheet

2. Hot Applied Modified Bitumen Mid-Ply: Approximately 90 mil high performance modified bitumen mid-ply consisting of a lightweight mat impregnated and coated with high quality modified bitumen and having the following properties:
a. Approved Product:
1) Firestone Product: SBS Base
2) JM Product: DynaBase

3. Torch Applied Modified Bitumen Cap-Ply: Approximately 155 mil or better high-performance modified bitumen “cool roof” reflective white cap-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. Solar Reflectance (avg.) : greater than 3 year aged .75
c. Thermal Emittance (avg.): greater than 3 year aged .75.
d. Solar Reflectance Index (avg.): greater than 3 year aged 64.
e. Approved Product:
1) Firestone Product: SBS Glass FR Torch Ultrawhite
2) JM Product: Dynaweld Cap FR CR

4. Stripping Ply: Same as roof system mid-ply.

2.3 FLASHING MEMBRANE ASSEMBLY

A. A flashing membrane assembly consisting of two (2) plies of reinforced, polymer modified asphalt membrane.
1. Modified Bitumen Foil Faced Flashing Sheet:
a. Approved Product:
1) Firestone Product: SBS Metal Flash AL
2) JM Product: DynaClad AL

2. Reinforcing Ply: Same as roof system mid-ply.

2.4 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. MCA and MCQ only.

2.5 ROOFING SHEET METAL

A. Refer to Section 07 62 00, Sheet Metal Flashing and Trim.

2.6 ROOF INSULATION

A. Roofing Insulation:
1. 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 EPS in lwic system.

2. Tapered Edge Strip: 1-1/2 inches to 0 inches (or as required, field verify), 18 inches x 48 inches, install at all expansion joints, curbs, projections, crickets, saddles, and base flashings. Approved material shall be as manufactured by Cant Products or pre-approved equal.

2.7 ROOFING ACCESSORIES

A. Roofing Adhesives:
1. 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: Valero Low Fume asphalt or as required by membrane.

B. Bituminous Cutback Materials:
1. Primer: A high flash, quick drying, asphalt solvent blend which meets or exceeds ASTM D41 requirements.
2. Plastic Cement: 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.
3. Flashing Cement: A heavy-bodied all-weather trowel grade mastic, used as a base for laying-up cold process flashing membrane where fast setting adhesives are required.

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 cap-ply.

E. 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. Walk pads shall have contrasting granule color from surfacing.

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 into wood: Shall be a minimum #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. Stainless Steel 304 when used with ACQ treated lumber.
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.
5. Nails: Stainless Steel ring shank, size as required to suite application, minimum 11 gauge with 3/8-inch diameter head.

G. 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.

2.8 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 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. When 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. 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.
6. Termination Bar:
    a. Material: Extruded aluminum bar with lip profile.
    b. Size: 0.090 inch thick by 3/4 inch wide with 3/16-inch lip width and a 45-degree lip angle, factory punched 1/4-inch x 3/8-inch oval holes spaced six (6) inches on center.
    c. Approved Product/Manufacturer: “LIPTB 06” manufactured by Olympic Manufacturing Group, Inc., or approved equal.

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 manufacturer’s recommendations.

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 installation 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, and exercise care in ensuring that the finished application is acceptable to the Owner.

C. Application of materials shall be in strict accordance with the manufacturer's recommendations except where more stringent requirements are shown or specified. In the instance of a conflict between these specifications and those of the manufacturer, the more stringent specifications shall take precedence.

D. General Installation:
1. Protect adjacent areas with tarpaulin or other durable materials.
2. Contractor shall prevent overspray and be responsible for parking lot areas and/or adjoining areas not part of this contract.
3. Contractor shall be responsible for sealing, as required, all openings that may allow bitumen migration or drippage, i.e., pitch dams, envelopes, and filler strips.
4. Prepare surfaces according to manufacturer's or applicator'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. All Kynar 500 or Hylar 5000 finished metal shall be buff sanded on the surface which is to be primed prior to the application.
5. Use cleaning materials or primers necessary to render an acceptable surface/substrate.
6. All surfaces/substrates shall be clean and dry prior to application of materials. Roof deck substrates shall be inspected for moisture in accordance with the manufacturer’s recommendations. Architect’s representative shall witness inspection. Roofing installed before inspection by Architect’s representative shall be removed to allow inspection.
7. 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.
8. Ambient temperature shall be 45 degrees F and rising.
9. 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. Kettle shall be kept a minimum of 20 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. All kettles are to have afterburners installed to reduce fume emissions.
10. 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.
11. 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.

12. 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.
13. Membrane Adhesive Application: 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.)
14. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.
15. Circulate bituminous materials, do not allow bituminous materials to stand in luggers for long periods. Use insulated hot transport lines and luggers.
16. Keep kettle lid closed except when adding bitumen.
17. Wrinkles, buckles, kinks, and fishmouths are not acceptable when laying felt and membrane.
18. Dry voids of felt on felt are not acceptable.
19. Primed cant strips shall be installed at the intersection of the deck and the vertical surfaces.
20. 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 above the finished membrane height.
21. 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.
22. Correct all errors in application the same workday they occur, including voids, fishmouths, dry laps or spots, wrinkles, ridges, blisters, bare spots, improper application, physical damage, and all work not meeting specifications.
23. Follow manufacturer’s recommendation for application of cold adhesive due to slope requirements.

3.3 NAILERS (MCQ and MCA only)

A. Wooden nailers shall be installed at perimeter edges or drip edges on outside perimeter of building in accordance with FM Global 1-49 securement requirements. All deck penetrations (soil stacks, mechanical curbs, etc.) shall receive wooden nailers stacked minimum 3/4 inch above designed deck thickness.

B. All Construction: Nailers shall be the same height as the finished height of the insulation layer. 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 three (3) feet on center maximum or as required by FM Global 1-49 requirements. Provide nailers at all penetrations. Install/Raise all curbs, etc, a minimum of ten (10) inches above roof deck.

3.4 SUBSTRATE PREPARATION

A. At Lightweight Insulating Concrete Deck Systems: Nailable fills shall receive base/anchor 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.

B. Substrate Surface: Prepare substrate surfaces to insure proper and adequate installation, in strict accordance with the Contract Documents and approved Shop Drawings, or manufacturer's requirements.

C. Fill all gaps and voids between substrate components that are wider than 1/4 inch. Fill all gaps with same materials as the substrate.

D. The membrane manufacturer shall specify types of substrates that are suitable for use with the bonding adhesive.

E. Protection of Adjacent Areas or Surfaces: Protect adjacent areas or surfaces from damage as a result of the Work of this section. Remove sharp projections.

F. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

G. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of the roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

3.5 APPLICATION OF BASE/ANCHOR SHEET AT LIGHTWEIGHT CONCRETE DECK

A. Lightweight concrete deck shall be covered with a base/anchor 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 contractor'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 MEMBRANE 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. Bitumen Consistency: Cutting or alterations of bitumen, primer, and sealants will not be permitted.

D. Roofing Application: 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 mid-ply layer and the cap-ply layer shall not coincide. Stagger the courses to ensure this.

1. Apply all layers of roofing so that water flows over or along lap seams, but never against laps.
2. Mechanically attached the base/anchor sheet to the lightweight concrete per manufacturers fastening pattern. Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps.
3. Fully bond the mid-ply to base/anchor sheet with hot asphalt. Each sheet shall have minimum three (3) inch side laps and six (6) inch end laps. Each sheet shall be applied directly behind the hot asphalt applicator. Stagger end laps a minimum of three (3) feet.
4. Fully bond the cap-ply to the mid-ply with torch. Each sheet shall have a minimum of three (3) inch side and six (6) end laps. Each sheet shall be applied directly behind the torch applicator. Stagger end laps of the cap-ply a minimum of three (3) feet. Stagger side laps of the cap-ply a minimum of 12 inches from side laps in the underlying mid-ply. Stagger end laps of the cap-ply a minimum of three (3) feet from end laps in the underlying mid-ply.
5. 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.
6. 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.

E. Granule Embedment: Broadcast mineral granules over all bitumen overruns on the cap-ply surface, while the bitumen is still hot, to ensure a monolithic color and adhesion.

3.7 ROOF FLASHING MEMBRANE INSTALLATION

A. Flashing - General:

1. Flashings shall be installed using the manufacturer's 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 wolmanized 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 (seal top with three (3) coursing), 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.
8. Exert sufficient pressure on the flashing membrane to ensure the prevention of air pockets. This can be accomplished by using a damp, kitchen type sponge mop or a damp, heavy duty cotton nap paint roller.
9. Prime all end laps of the flashing membrane with a uniform coating of the specified asphalt primer and allow to thoroughly dry prior to overlapping of adjoining sheets.
10. Probe laps using a clean, heated roofing trowel and heat fuse dry laps of the flashing membrane to ensure a complete seal.

B. Flashing Application - Masonry Surfaces: Flash masonry parapet walls and curbs using the using the reinforcing sheet and the metal foil flashing membrane. After the mid-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 mid-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 mid-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 cap-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 (preferred liquid 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. Strip-in flange with specified stripping ply and cap with cap-ply. Provide flashing membrane target.
2. Square Projections: Strip in all flanges on square projections with specified stripping ply and cap with cap-ply. Provide flashing membrane target. Provide tapered edge strips around base. Cricket up-side slope.
3. Prime all flanges prior to setting in a bed of mastic. Install to manufacturer's specifications. Provide tapered edge strips around base as required. Cricket up-side slope.
4. Round Projections: Strip in all flanges on round projections with specified stripping ply and cap with cap-ply. Provide flashing membrane target.
5. Prime all metal prior to setting in mastic. Install to manufacturer's specifications.

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. Walkway Pads:
1. Provide walk pads shall be installed at point of roof access, at service points of all roof mounted equipment requiring periodic maintenance.
2. Protection pads shall have rounded corners and extend minimum four (4) inches beyond edge of overlying element.
3. Provide new protection pads under all pipe supports, at HVAC and mechanical access points, in front of all roof top doors and openings.

G. Perimeter Edge Flashing: Refer to Section 07 62 00.

H. Bleed out of flashing membrane: Broadcast bulk aluminum powder over all bitumen overruns on the flashing membrane surface while the bitumen is still hot to ensure a monolithic surface color. With approval of manufacturer, a premium glossy aluminum paint may be used.

3.8 OVERNIGHT SEAL / WATER CUT-OFF

A. Over Night Seal: Shall be performed according to accepted roofing practice as outlined in the NRCA Roofing Manual.

B. 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.

3.9 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 mid-ply and cap-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. Sealant: Caulk all exposed cap-ply edges at gravel stops, waste stacks, pitch pans, vent stacks, etc., with a smooth continuous bead of approved sealant or per manufacturers requirements.

C. Sheet Metal: Refer to Section 07 62 00, ROOF RELATED SHEET METAL.

3.10 FIELD QUALITY CONTROL AND INSPECTIONS

A. Roof cuts shall be performed and repaired at contractor'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 x 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.

3.11 CLEANING AND PROTECTION

A. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean and shall allow no roofing materials to remain on the outside walls.

B. Leave all areas around job site free of trash, debris, roofing materials, equipment, and related items after completion of job.

C. All bituminous or roofing related materials shall be removed from ladders, stairs, railings, and similar parts of the building.

D. Remove bitumen stains from walls, walkways, and driveways.

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sheet metal flashing and trim.

B. Related Sections:
1. Section 07 92 00 - Joint Sealants.
2. Section 09 91 00 - Painting.

1.2 SUBMITTALS

A. Samples:
1. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Submit for approval samples of parapet coping cover expansion joint and soldered joint.

B. Product Certificates: Showing that each type of coping and roof edge flashing is ANSI/SPRI/FM 4435/ES-1 tested.

C. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.

1.3 QUALITY ASSURANCE

A. Standard: Comply with the requirements of the Architectural Sheet Metal Manual published by SMACNA.

B. Installer Qualifications: Company specializing in sheet metal flashing work with three years minimum experience in similar sized installations.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle and protect products under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Stack pre-formed material to prevent twisting, bending, and abrasions, and to provide ventilation.

C. Prevent contact with materials which may cause discoloration or staining.

1.5 WARRANTY

A. Furnish to the Owner a written warranty providing the following without cost to the Owner.
1. Sheet metal roof flashings shall be maintained in normal repair and free of leaks for a period of 2 years from the date of acceptance of the roof.
2. At end of 2-year period, Owner and Contractor shall make final inspection of flashing work. Holes, breaks and other defects shall be promptly repaired at the Contractor's expense.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Components not Visible from Ground Level: Roof top accessories, including but not limited to, expansion joint covers, flanges, and concealed counterflashings shall be stainless-steel, ASTM A 666, unless jurisdiction requires ASTM A 240, Type 304, dead soft or fully annealed as required, with smooth, flat surface.
1. Minimum 24-gauge thickness unless noted otherwise.
2. Finish: 2D (dull, cold rolled)

B. Components Visible from Ground Level: Including but not limited to, coping, edging, gutters, conductor heads, downspouts, and expansion joint terminations shall be galvanized steel sheet with prefinished fluorocarbon coating containing 70% Kynar 500.
   1. Thickness as specified.
   2. Finish: Two-coat fluoropolymer. Colors shall be selected by Architect from Fluropon Standard colors as manufactured by Valspar.

C. Reglet: Two-piece snaplock receiver, Per Figure 4-4C, SMACNA Manual, 8th Edition, of 24 gauge stainless steel.

D. Underlayment: ASTM D 226, 30 lb/100 s.f. weight felt containing no additives corrosive to sheet metals.

E. Solder: ASTM B 32, made from block tin and pig lead (50/50) with no antimony.

F. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with an acid flux of type recommended by stainless-steel sheet manufacturer.

G. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.

H. Sealant: Two component polyurethane, non-sagging, sealant as specified in SECTION 07 92 00 - JOINT SEALANTS.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

J. Miscellaneous items such as nails and mastic shall be furnished as required by the conditions of use and must be of the best grade available.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, free from distortion and defects, to profiles indicated in accordance with SMACNA Architectural Sheet Metal Manual.

B. Fabricate cleats and starter strips of same material as sheet, interlockable with sheet.

C. Form pieces in longest practical lengths.

D. Hem exposed flashings on underside ½"; miter and seam corners.

E. Solder and seal metal joints except those indicated or required to be expansive type joints. After soldering, remove flux. Wipe and wash solder joints clean.

F. Fabricate corners from one place with minimum 18" long legs; solder for rigidity; seal with sealant.

G. Fabricate vertical faces with bottom edge formed outward ¼" and hemmed to form drip.

H. Fabricate flashings to allow toe to extend minimum 2" over wall surfaces.

I. Fabricate as much as possible in shop with machinery to eliminate as much hand tooling on the job as possible. Shop fabricate to allow for adjustments in the field for proper anchoring and joining.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

B. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

C. Verify membrane termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Field measure site conditions prior to fabricating work.

B. Install starter and edge strips, and cleats before starting installation.

C. Install surface mounted reglets true to lines and levels. Seal top of reglets with sealant.

D. Install one layer of underlayment prior to installing copings.

3.3 INSTALLATION

A. General: Fabricate, assemble, and install sheet metal work in conformance with referenced standard.
1. Make adequate provision for metal expansion and contraction without buckling or splitting. Use cleats and watertight slip and expansion joints.
2. Nails and screws shall be of the same metal as the member on which used. Nails through exposed wash surfaces will not be permitted.
3. When soldering, use flux and wash off surplus flux after soldering has been completed.
4. Set sheet metal with horizontal lines straight and level. Surfaces shall be flat without wrinkles and waves. Profiles shall align at joints with no offsets.
5. Conform to drawing details included in manuals published by SMACNA and NRCA.
6. Edge Securement for Low-Slope Roofs: Design in accordance with ANSI/SPRI ES-1 for basic wind speed zone with 3-second gusts.
7. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
8. Seal metal joints watertight.
9. Provide electrolytic separation between dissimilar metals with protective back paint.

B. Reglet: Install surface mounted reglets on walls.
1. Clean surface of oil, grease and loose particles.
2. Place sealant bead on back in groove and on lap.
3. Secure reglet in precise alignment to wall with power driven pins spaced 12" o.c.
4. Lap joints 3" and bed in sealant. Miter and seal corners.

C. Reglet Counterflashing: Counterflashing for reglet shall be formed of 24 gage metal to fit the reglet in conformance with the manufacturer's instructions.
1. Lap counterflashing down over flashing strip approximately 4" and form lower edge with a spring bend against the base flashing.
2. After roofing and flashing strip have been installed, snap counter-flashing up into reglet so that it is held securely in place without screws or clips.
3. Lap end joints 3" and bed in sealant. Miter and seal corners.

D. Parapet Coping Cover: Form and install coping covers and fascia covers of 24 gage metal. Finish coping covers with a fluorocarbon coating containing 70% Kynar 500. Color shall be selected from Fluropon Standard colors as manufactured by Valspar.
1. Make up the coping in 10 ft. lengths.
2. Bend outside bottom edge to form drip and lock to continuous cleat, 22 gage min., secured to wood blocking with nails and to masonry with screws into expansion shields.
3. On roof side copings shall be fastened through slotted holes located 2' o.c. with screws and watertight washers.
4. Provide loose-locked expansion joints filled with sealant where each 10' section meets. Provide an expansion joint within 10 ft. of each corner.
5. Corners shall be mitered, locked and soldered seams.

E. Vent Stack Roof-Penetration Flashing: Flashing shall have a weight range of 2 – 4 lbs/sq. ft. Coordinate installation of roof-penetration lead flashing flange with installation of roofing and other items penetrating roof. Base flashing shall be flanged 4 in. onto the roof. The flange is fastened through the roofing felts and is then stripped in by the roofer. Turn the top of the flashing down inside the vent pipe. Seal with sealant per Section 07 92 00 – Joint Sealants, and clamp flashing to pipes that penetrate roof.

F. Downspout: Form and install downspouts of 24 gage metal.
   1. Install with the top slipped up over the outlet sleeve and anchor to the wall with 2" wide by 18 gage metal straps fastened with galvanized bolts into metal expansion shields.
   2. For each downspout, set the straps at the top, bottom and at intermediate points spaced not more than 8' apart.

G. Gutter: Form and install hung molded gutters of 26 gage metal at roof eaves.
   1. Provide watertight lap or butt type expansion joints at intervals of 50 ft. and not more than 16 ft. from inside and outside corners.
   2. Support molded outside edge with 1" wide 18 gage strap hangers at 36" centers and weld to gutter as detailed.
   3. Form downspout outlet sleeves and rivet and solder sleeves to gutter. Fit each sleeve with a removable, galvanized wire basket strainer.
   4. Provide lock-in black metal mesh gutter guards manufactured by Amerimax Home Products, 3125 Great SW Parkway Suite 300, Grand Prairie Tx 75050; 972 647 2505.

H. Roof-Edge Fascia: Manufactured, two-piece, roof-edge fascia consisting of snap-on metal fascia cover in section lengths not exceeding 12 feet and a continuous metal receiver with integral drip-edge cleat to engage fascia cover and secure modified roof membrane. Provide matching corner units.
   1. Metallic-Coated Steel Sheet Fascia Covers: Zinc-coated (galvanized) steel, nominal thickness as required to meet performance SPRI ES-1 requirements.
      a. Surface: Smooth, flat finish.
      b. Finish coping covers with a fluorocarbon coating containing 70% Kynar 500. Color shall be selected by Architect from Fluropon Standard colors as manufactured by Valspar.

I. Splash Pans: Provide 24 gage stainless steel splash pans where downspouts discharge onto roofs. Install pans in mastic (mastic must be approved by membrane manufacturer) to set flat on the roof and secure to downspouts by riveting and soldering.

J. Miscellaneous flashings and other items of sheet metal roof work shall be provided as required for a weathertight job.

END OF SECTION

SECTION 07 65 00

FLEXIBLE FLASHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concealed through-wall flashing system.

B. Related Sections:
1. Section 04 20 00 - Masonry Units.
2. Section 05 40 00 - Cold-formed Metal Framing.
3. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System.
4. Section 07 27 26 - Fluid-Applied Membrane Air Barriers.

1.2 GENERAL

A. Contractor shall review American Concrete Institute 530.1 mandatory specification checklist for additional requirements necessary for specific project.

1.3 QUALITY ASSURANCE

A. At a scheduled pre-construction meeting with all trades, contractor shall review flashing for the project and how the flashing shall be sequenced with the following: below grade waterproofing, air and vapor system, window installation, sealant installation, relief angles and roofing.

1.4 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Contractor shall provide from the manufacturer a review of the flashing design for the project and location of preformed shapes on reduced floor plan.

C. Product Certificates: From flexible flashing manufacturer, certifying compatibility (including adequate adhesion) of flexible flashing and accessory materials with Project materials that connect to or that come in contact with flexible flashing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original, unopened containers and rolls with all labels intact and legible including labels indicating appropriate warnings, storage conditions, lot numbers, and usage instructions. Materials damaged in shipping or storage shall not be used.

B. Manufacturer's packaging and/or roll plastic is not acceptable for exterior storage. Tarpaulin with grommets shall be minimum acceptable for exterior coverings. All materials stored as above shall be a minimum of four inches (4") off the substrate, and the tarpaulin tied off with rope.

C. Deliver materials in sufficient quantity to allow continuity of work.

D. Handle and store material in such a manner as to avoid damage.

E. Protect materials against damage by construction traffic.

F. Storage: All materials should be stored under cover to avoid site damage. During cool weather construction, store materials inside at 50º F or higher.

G. The proper storage of materials is the sole responsibility of the contractor and damaged materials shall be discarded, removed from the project site, and replaced prior to application.

1.6 SITE CONDITIONS

A. Job Condition Requirements: Coordinate the work of the contractor with the work to be performed by the Owner's personnel, to ensure proper sequencing of the entire work. The contractor shall follow local, state, and federal regulations, safety standards, and codes. When a conflict exists, use the stricter document.

B. Protection of Work and Property:
   1. Work: The contractor shall maintain adequate protection of all his work from damage and shall protect the Owner's and adjacent property from injury or loss arising from this contract. He shall provide and maintain at all times any OSHA required danger signs, guards, and/or obstructions necessary to protect the public and his workmen from any dangers inherent with or created by the work in progress. All federal, state, and city rules and requirements pertaining to safety and all EPA standards, OSHA standards, NESHAP regulations shall be fulfilled by the contractor as part of his proposal.
   2. Property: Protect existing planting and landscaping as necessary or required to provide and maintain clearance and access to the work of this contract. Examples of two categories or degrees of protection are generally as follows:
      a. removal, protection, preservation, or replacement and replanting of plant materials.
      b. protection of plant materials in place, and replacement of any damage resulting from the contractor's operations.

C. Damage to Work of Others: The contractor shall repair, refinish, and make good any damage to the building or landscaping resulting from any of his operation. This shall include, but is not limited to, any damage to plaster, tile work, wall covering, paint, ceilings, floors, or any other finished work. Damage done to the building, equipment, or grounds shall be repaired at the successful contractor's expense holding the Owner harmless from any other claims for property damage and/or personal injury.

D. Measurements: It will be the contractor's responsibility to obtain and/or verify any necessary dimensions by visiting the job site, and the contractor shall be responsible for the correctness of same. Any drawings supplied are for reference only.

E. Cleaning and Disposal of Materials:
   1. Contractor shall keep the job clean and free from all loose materials and foreign matter. Contractor shall take necessary precautions to keep outside walls clean.
   2. 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. At completion, all work areas shall be left clean and all contractor's equipment and materials removed from the site.
   3. Debris shall be deposited at an approved disposal site.

PART 2 - PRODUCTS

2.1 BUILT-IN FLASHING MEMBRANE (ELVALOY® SHEET)

A. The built-in flashing membrane shall be 40 mil flexible sheet material, consisting of a blend of elastomeric and thermal plastic polymers, incorporating DuPont™ Elvaloy® The membrane shall be reinforced with synthetic fibers, calendered into sheet form, rolled and cut to width.

B. Cloaks shall be pre-formed, three dimensional flexible units used for detail corners, level changes, stop ends, and special applications.

Physical Properties		
Elongation	175%	ASTM D412
Tensile Strength	650 psi	ASTM D412
Tear Strength	280 psi	ASTM D624
Low Temperature Flexibility	-25º F Pass	ASTM D146
Water Absorption	Less than 0.1%	ASTM D471

2.2 RELATED MATERIALS FOR BUILT-IN FLASHING MEMBRANE

A. Joint Support Boards: Aid the mason in lap formation by providing a flat work surface and in-cavity support for membrane joints. The boards shall be used under all membrane to membrane laps.

B. Double-Sided Tape: Shall be a two-sided, self-adhering tape used to seal joints in membrane and joints between membrane and cloaks. Adhesive may be used as an alternative.

C. Drip Plate: Type 304 stainless steel, 26 ga., 3-1/2" drip plate with prefabricated inside/outside corners and end dams. Basis of Design shall be Hohmann & Barnard #DP. At locations detailed without an exposed drip edge, the Basis of Design shall be #FDP.

D. Mastic: Shall be used at all laps and joints.

2.3 SURFACE-ADHERED FLASHING MEMBRANE (ELVALOY® SHEET)

A. Surface-adhered membrane shall be a composite 40 mil membrane consisting of 25 mils of elastomeric/thermal plastic membrane incorporating DuPont™ Elvaloy® and 15 mils of SBS asphaltic adhesive. The membrane shall be reinforced with synthetic fibers, calendered into sheet form, rolled and cut to standard widths.

B. Standard Sheet Dimensions:

Thickness	40 mil
Roll length	75 ft
Roll widths	12, 18, 24, 36 in

C. Cloaks shall be pre-formed, three dimensional flexible units used for detail corners, level changes, stop ends, and special applications.

Physical Properties		
Elongation	225%	ASTM D412
Tensile Strength	875 psi	ASTM D412
Tear Strength	270 psi	ASTM D624
Low Temperature Flexibility	-25º F Pass	ASTM D146
Water Absorption	Less than 0.1%	ASTM D471

2.4 RELATED MATERIALS FOR SURFACE ADHERED FLASHING MEMBRANE

A. Double-Sided Tape: Shall be a two-sided, self-adhering tape used to seal the top of cloaks against the back-up wythe. Adhesive may be used as an alternative.

B. Mastic: Shall be used at all laps and joints, and top terminations.

C. Termination Bars for Flexible Flashing: Type 304 Stainless steel bars 1/8" x 1". Basis of Design shall be Hohmann & Barnard #T1.

D. Drip Plate: Type 304 stainless steel, 26 ga., 3-1/2" drip plate with prefabricated inside/outside corners and end dams. Basis of Design shall be Hohmann & Barnard #DP. At locations detailed without an exposed drip edge, the Basis of Design shall be #FDP.
1. Manufacturer shall grind down point of prefabricated outside corners to provide a rounded corner, free from sharp points and edges, prior to shipment of material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with requirements for installation tolerances and other specific conditions.

3.2 GENERAL

A. Laying Masonry Walls: Use an inverted lintel CMU or fully grouted hollow CMU as a base for flashing at sills, floor joints, and other similar conditions.

B. Preparation: All sharp protrusions and mortar droppings must be removed from the substrate, and the surface must be clean and dry.

C. Where brick work occurs about the roof elevation, provide solid protection of the existing roof system until work is complete.

3.3 INSTALLATION OF BUILT-IN FLASHING MEMBRANE (ELVALOY® SHEET)

A. Set drip plate in full bed of sealant. Lap joints 3" with bead of sealant between and tooled sealant on top edge of overlap. Flashing membrane and cloaks shall be installed in a bed of fresh mortar.

B. Weep holes shall be provided immediately above all flashing at 24-inch centers. A minimum of two weeps shall be installed above any wall opening.

C. All joints in the flashing membrane shall be lapped a minimum of four inches (4") using double sided tape or flashing adhesive and a joint support board.

D. Flashing membrane shall be installed six inches (6") above top of cavity drainage material.

E. Cloaks and end dams shall be installed at all window and door heads and sills.

F. Vertical flashing at wall openings shall extend into the wall opening one inch (1"). The door/window frame shall be installed with the flashing extending into the frame.

G. Cleaning: Flashing membrane shall not be damaged by cavity cleaning after installation. Precautions to be taken during subsequent work are:
   1. Use of cavity battens to prevent mortar droppings;
   2. Removal of droppings before they harden;
   3. Never use implements such as steel rods for cleaning the cavity; and
   4. Inspection of cavity flashing for damage as the work proceeds.

3.4 INSTALLATION OF SURFACE-ADHERED FLASHING MEMBRANE (ELVALOY® SHEET)

A. Priming: If the surface-adhered flashing membrane will not adhere to the substrate or the substrate is dusty or dirty, the area shall be primed. Flashing primer shall be applied with a brush, roller or sprayed. Coverage is approximately 400 square feet per U.S. gallon (3.78L). Drying time may vary depending on temperature, humidity, and air movement; drying time should be approximately 45 minutes.

B. Flashing System Installation: Starting at a corner, mount cloak to substrate using double-sided tape or flashing adhesive. Cut surface adhered membrane into workable sections (8'-10'). Remove the release sheet and adhere the membrane to the inner leaf of construction lapping the membrane onto the cloak four inches (4"). Use firm hand pressure and a steel roller to totally adhere membrane in place. Extend membrane completely through the outer leaf and leave it exposed ¼" minimum. The surface-adhered membrane is not UV sensitive. Apply a bead of flashing mastic to all top termination edges.

C. Termination Bar: The surface-adhered membrane shall be installed using a termination bar for additional attachment to the inner leaf.

D. Weep holes shall be provided immediately above all flashing at 24-inch centers. A minimum of two baffle weeps shall be installed above any wall opening.

E. Flashing membrane shall be installed six inches (6") above top of cavity drainage material.

F. Stop end cloaks shall be installed at all windows, door heads, sills, and through-wall starts, stops, steps, etc.

G. Enveloped vertical flashing at wall openings shall extend into the wall opening one inch (1"). The door/window frame shall be installed with the flashing extending into the frame. Enveloped vertical flashing shall be installed at all abutments of dissimilar exterior wall treatments: inside and outside nineties (90°), etc.

H. Cleaning: Flashing membrane shall not be damaged by cavity cleaning after installation. Precautions to be taken during subsequent work are:
   1. Use of cavity battens to prevent mortar droppings;
   2. Removal of droppings before they harden;
   3. Never use implements such as steel rods for cleaning the cavity; and
   4. Inspection of cavity flashing for damage as the work proceeds.

3.5 FLASHING SCHEDULE

A. Flashing as follows with membrane:
   1. Over steel lintels, plates and angles in exterior masonry walls.
   2. Within masonry parapets and walls as through flashing to detail.
   3. At the bottom of cavity walls with weep holes.
   4. Under window sills to detail.
   5. Elsewhere in walls where indicated.

END OF SECTION

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SECTION 07 72 13

MANUFACTURED ROOF CURBS AND PORTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Prefabricated roof curbs and penetration portals.

B. Related Sections:
1. Section 05 31 00 - Steel Decking.
2. Section 05 50 00 - Metal Fabrications.
3. Section 06 10 00 - Rough Carpentry: Field-constructed curbs and cants.
4. Section 07 55 52 - Modified Bituminous Membrane Roofing.
5. Section 07 62 00 - Sheet Metal Flashing and Trim: Flashings and counter-flashings.
6. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. General: Submit following items under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Indicating technical and performance data of products.

C. Shop Drawings: Indicating details of special connections and transitions, typical section details, and layout showing intended locations for use of products.

D. Manufacturer's Instructions: Printed instructions for recommended installation methods and sequences for all products.

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: Company specializing in the manufacturing of prefabricated roof expansion joints for a minimum of 5 years.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Prevent contact with materials which may cause discoloration or staining.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

A. Acceptable Products and Manufacturers
1. Roof Curbs: RPS Expansion Curbs (EC-2B, with 2" extended flange), Roof Curbs (RC-2B) and Equipment Rail (ER-2B) by Roof Products and Systems Corp., Bensenville, Illinois.
2. Penetration Portals: Alumi-Flash by Portals Plus, Bensenville, Illinois.
3. Pipe Mounting Pedestal: For pipes 2" to 3-3/4" o.d., provide Model 3-R-2 Pedestals as manufactured by Miro Industries, Inc. Murray, Utah.

B. Substitutions: Submit in accordance with SECTION 01 62 00 - PRODUCT OPTIONS.

2.2 SIZES AND CONFIGURATIONS

A. Provide in sizes and configurations as required to accommodate joint widths, penetrations, and equipment being supported.

B. Provide configurations and special transitions as shown or required to utilize factory formed pieces wherever possible.

C. Provide custom factory-formed pieces conforming to roof slope to allow for a level equipment installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

B. Verify that curbs are level and flashing reglets have been installed at proper locations.

C. Verify that insulation has been packed into joint prior to beginning work.

3.2 INSTALLATION

A. Interface with other systems. On roof mounted expansion joints, set flanges in adhesive and make watertight over cant strip.

B. Install using skilled workmen in accordance with manufacturer's printed instructions and recommendations.

C. Anchor units securely with fasteners and at spacing as recommended by manufacturer.

D. Where metal surfaces are to be in contact with corrosive substrates, apply bituminous coating on concealed metal surfaces.

E. Splice sections of curbs together with procedures as recommended by manufacturer for a solid, watertight installation.

F. Penetrations of piping through equipment curbs shall not be permitted.

G. Utilize factory fabricated intersections and transitions wherever possible. Field fabricate where pre-manufactured sections are not available.

3.3 PROTECTION

A. Protect completed installation under provisions of SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS.

END OF SECTION

SECTION 07 72 33

ROOF HATCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Roof hatches, including ladder safety post and hatch rail system.

B. Related Sections:
1. Section 05 31 00 - Steel Decking.
2. Section 05 50 00 - Metal Fabrications; angles miscellaneous metal, and ladder fall arrest systems.
3. Section 06 10 00 - Rough Carpentry.
4. Section 07 41 20 - Prefinished Metal Roof Panels.
5. Section 07 55 52 - Modified Bituminous Membrane Roofing.
6. Section 07 62 00 - Sheet Metal Flashing and Trim: flashing of the hatch curb.
7. Section 07 72 13 - Manufactured Roof Curbs and Portals.
8. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include complete manufacturer's catalog cuts and installation requirements for each item specified.

1.3 WARRANTY

A. Provide manufacturer’s standard warranty. Materials shall be free from defects in material and workmanship for a period of:
1. Roof Hatch: Five years.
2. Ladder Extension: Five years.
3. Roof Hatch Rail System: Five years.

PART 2 - PRODUCTS

2.1 ROOF HATCHES

A. Roof Hatches: Provide single leaf roof hatches, 2'-6" x 3'-0", of 14 gage galvanized/galvannealed steel with 22 gage galvanized/galvannealed steel liner. Product/manufacturer; one of the following:
Model No. BRHU; Babcock-Davis Hatchways Inc.
Type S-20; The Bilco Co.
Model No. SAH-CM-12; Bristolite Daylighting Systems
Model No. RB-1; Milcor Limited Partnership
Model No. RHU; Nystrom

B. Construction:
1. Hatch shall be factory assembled with heavy pintle hinges, compression spring operators, positive snap latch with turn handles, padlock hasps and neoprene draft seals.
2. Curb shall be 12" high with 3½" flanges, fully welded at corners and equipped with integral metal cap flashing.
3. Cover shall be insulated with concealed 1" thick fiberglass insulation.
4. Curb shall be insulated with 1" thick fiberboard insulation. Fiberglass insulation is not acceptable.
5. Cover shall have an automatic hold-open arm with red vinyl grip handle. All hardware shall be cadmium plated.

2.2 LADDER EXTENSION

A. Basis of Design: Provide ladder extension Model LU-2, “LadderUP” Safety post as manufactured by The Bilco Company.
1. 42" high telescoping extension.
2. Post shall lock automatically when fully extended. Release lever shall disengage the post to allow it to be returned to its lowered position.

3. Adjustable mounting brackets shall fit ladder rung spacing and clamp brackets shall accommodate ladder rungs.
4. Balancing Spring: A stainless steel spring balancing mechanism shall be provided to provide smooth, easy, controlled operation when raising and lower the safety post.
5. Hardware: All mounting hardware shall be Type 316 stainless steel.
6. Finish: Factory finish of post shall be hot dipped galvanized steel.

2.3 ROOF HATCH RAIL SYSTEM

A. Basis of Design: Where noted on drawings, provide Bil-Guard roof hatch rail system Model RL2-S as manufactured by The Bilco Company.
   1. Hatch rail system shall satisfy the requirements of OSHA 29 CFR 1910.29 and shall meet OSHA strength requirements with a factor of safety of two.
   2. Posts and rails shall be 1¼" schedule 40 pipe in 6061 T6 aluminum alloy.
   3. Hardware shall be Corrosion resistant construction. Locking mechanism is cast aluminum and spring hinges and all fasteners are type 316 stainless steel.
   4. Curb mounting brackets and teardrop brackets are 6063 T5 aluminum extrusion. Hinges and post guides shall be 6063T5 aluminum. Fasteners shall be Type 316 stainless steel.
   5. Self-closing gate.
   6. Color: Safety yellow.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that ladder safety post or hatch rail system installations will not disrupt other trades.

B. Verify that the ladder rungs are dry, clean, and free of foreign matter.

C. Report and correct defects prior to any installation.

3.2 INSTALLATION

A. Roof Hatch: Install roof hatches in accordance with the manufacturer's recommendations. Securely fasten to the roof deck with bolts or screws.

B. Roof Hatch Railing System: Hatch rail system shall attach to the cap flashing of the roof hatch and shall not penetrate any roofing material.

C. Installer shall field check conditions and verify the manufacturer's ladder safety post and hatch rail system details for accuracy to fit the application prior to fabrication.

D. Installer shall comply with the ladder safety post and hatch rail system manufacturer's installation instructions.

E. The manufacturer shall furnish fasteners necessary for installations.

END OF SECTION

SECTION 07 84 00

FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Firestopping for all fire-rated construction complete, including, but not limited to:
   1. Firestopping in conjunction with gypsum board, masonry and plaster partitions.
   2. Firestopping shall include, but not be limited to the following applications:
      a. Sealing gaps between tops of partitions and roof/floor decks.
      b. Sealing gaps between structure and glass curtainwalls with fire safing insulation.
      c. Other locations where "firestopping", "firestop", or "safing" is indicated.
      d. Where required by codes.
      e. Control joints and expansion joints in masonry or gypsum board fire-rated partitions.
      f. Expansion joints in roof and floor assemblies.

B. Related Sections:
   1. Section 04 20 00 - Masonry Units.
   2. Section 07 21 00 - Building Insulation.
   3. Section 07 92 00 - Joint Sealants.
   4. Section 09 21 16 - Gypsum Board Assemblies.
   5. Divisions 23 and 26.

1.2 SUBMITTALS

A. Refer to SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit copies of manufacturer's literature. Include data substantiating that materials comply with specified tested system requirements.

C. Samples: Submit duplicate samples of each type of firestopping material and accessories.

D. For those firestop applications that exist for which no UL tested system is available through a manufacturer, an engineering judgement derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgement drawings must follow requirements set forth by the International Firestop Council.

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Do not allow firestopping materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection.

1.4 PROJECT CONDITIONS

A. Do not install firestopping materials until building is completely enclosed and weathertight.

B. Coordinate installation with the work of other trades. Reference SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

PART 2 - PRODUCTS

2.1 PRODUCT/MATERIAL PERFORMANCE REQUIREMENTS

A. Except as otherwise indicated, firestop materials shall be classified in the Underwriters Laboratories (UL) Building Materials Directory, "Section XHEZ-Through-Penetration Firestop Systems", and/or "Section XHHW-Fill Void or Cavity Materials", and “Section XHBN - Joint Systems” for specific project conditions:
   1. Time rating ("F", Fire and "T", Temperature) (T-rating is only required for construction joint systems).
   2. Floor or wall assembly and material.
   3. Penetrating materials/items diameters, or void space.
   4. Through opening size.
   5. Annular space between penetration opening and penetrating item.

B. Firestopping materials shall provide a fire-rating commensurate with the adjacent construction rating.

C. Firestop materials shall comply with ASTM E 84: Surface Burning Characteristics.

D. Firestop materials shall have been tested in accordance with ASTM E 814, UL 1479 or UL 2079.

E. Firestop materials shall be free of asbestos.

F. Firestop materials shall be paintable or capable of receiving finish materials in those areas which are exposed to view and which are scheduled to receive finishes.

G. Obtain firestop products from a single manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Installer must examine substrate and conditions under which firestopping work is to be performed, and notify Contractor in writing of any unsatisfactory conditions.

3.2 INSTALLATION

A. Install firestopping materials including foaming, packing and accessory materials to fill openings around penetrations in floors and walls, to seal gaps between decks and partitions, gaps between structure and curtainwall, etc., to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Use silicone based materials for all wet or damp conditions.

B. Install firestop materials and systems in accordance with manufacturer's printed instructions and applicable UL Building Materials Directory assemblies.

C. Cut and friction fit fire safing type insulation firestopping to completely fill all gaps and voids. Provide stick-clips, sheet metal closures, and any other accessories to support insulation.

D. Where floor openings are 4" or more in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.

E. Remove damming materials after curing if made of other than fire resistant materials.

F. Protect materials from damage on surfaces subject to traffic.

3.3 FIELD TESTING

A. Firestop materials and installation shall be tested by an independent testing laboratory. Refer to SECTION 01 45 23 - TESTING AND INSPECTION SERVICES.

B. Where deficiencies are found or penetration and joint firestopping systems are damaged or removed due to testing, repair or replace penetration and joint firestopping systems so they comply with requirements.

C. Proceed with enclosing penetration and joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.4 CLEAN UP

A. Clean up all debris caused by the work of this Section, keeping the premises clean and neat at all times.

B. Clean adjacent surfaces soiled by the work of this section.

END OF SECTION

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SECTION 07 92 00

JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sealing and caulking of joints.

B. Related Sections:
1. Section 03 30 00 - Cast-In-Place Concrete.
2. Section 04 20 00 - Masonry Units.
3. Section 07 62 00 - Sheet Metal Flashing and Trim.
4. Section 08 41 18 – Aluminum Framed F=Entrances and Storefronts

1.2 SUBMITTALS

A. Submit under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submit product data indicating sealant chemical characteristics, performance criteria, limitations, color availability and application instructions.

C. Submit two samples ¼" diameter x 4" in size illustrating color selections available.

D. Submit manufacturer's certificate under provisions of SECTION 01 45 00 - QUALITY CONTROL that products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum 3 years documented experience.

B. Applicator: Company specializing in applying the work of this section with minimum 3 years documented experience and approved by sealant manufacturer.

C. Conform to Sealant and Waterproofers Institute requirements for materials and installation.

1.4 FIELD SAMPLES

A. Provide samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Construct one field sample joint, 5 feet long, illustrating sealant type, color, and tooled surface.

C. Locate where directed.

D. Accepted sample may remain as part of the work.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: No caulking shall be done at temperatures below 40°F.

1.6 WARRANTY

A. Furnish to the Owner a written warranty that the sealants shall remain watertight for a period of 2 years from the date of acceptance of the building. Joints which prove defective by leaking, cracking, melting or shrinking of the sealant shall be re-sealed without additional expense to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reference “SEALANT SCHEDULE” at end of this specification section for locations of Sealant Types.

B. Modified Polyurethane (Type 1 Sealant):
1. Two or three-part conforming to ASTM C 920, Type M, Grade NS, Class 25.
2. Color: Custom colors as selected by Architect.
3. Acceptable products:
MasterSeal NP2, BASF the Chemical Company
Dymeric 240FC, Tremco.

C. Pourable Urethane (Type 2 Sealant):
1. Multicomponent conforming to ASTM C 920, Type M, Grade P (pourable), Class 25, Use T (traffic).
2. Color: Custom color as selected by Architect.
3. Acceptable products:
Urexpan NR-200, Pecora Corp.
MasterSeal SL 2 Sealant; BASF the Chemical Company
THC 900 (Self leveling) or 901 (low sag), Tremco.

D. Pourable Urethane Sealant (Type 3 Sealant):
1. Single-component conforming to ASTM C 920, Type S, Grade P (pourable), Class 25, Use T (traffic).
2. Color: Gray or limestone as selected by Architect.
3. Acceptable products:
Sikaflex - 1CSL; Sika Corporation, Inc.
MasterSeal SL 1; BASF the Chemical Company
Vulkem 45; Tremco

E. Silicone, General Purpose (Type 4 Sealant)
1. One-part rubber based silicone conforming to ASTM C 920, Type S, Grade NS, Class 100/50.
2. Color: As selected by Architect.
3. Acceptable products
790 Building Sealant, Dow Corning.
SCS2700 Silpruf LM, GE Silicones.
Spectrem 1, Tremco.

F. Polyurethane Hybrid, Paintable (Type 5 Sealant):
1. One-part, moisture-cure, polyurethane hybrid sealant for interior use, conforming to ASTM C 920, Type S, Grade NS, Class 35 and Fed. Spec TT-S-00230C, Class A, Type II.
2. Acceptable product:
Dymonic FC, Tremco

G. Silicone, Sanitary (Type 6 Sealant):
1. One-part conforming to ASTM C 920, Type S, Grade NS, Class 25, F.D.A. Regulation 21 CFR177.2600, and FDA Food Additive Regulation 121.2514.
2. Color: Clear.
3. Acceptable products:
786 Silicone Sealant - M, Dow Corning.
SCS1700 Sanitary, GE Silicones.

H. Acrylic Latex (Type 7 Sealant)
1. One-part, non-sag acrylic latex, siliconized, conforming to ASTM C 834, Type OP, Grade NF or -18° C.
2. Acceptable products:
AC-20+, Pecora Corp.
MasterSeal NP 520; BASF the Chemical Company
Tremflex 834; Tremco.

2.2 ACCESSORIES

A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Joint Backing: ASTM D 1056 and C 1330. In vertical joints use closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width. In horizontal joints, use solid neoprene or butyl rubber, Shore A hardness of 70.

D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and joint openings are ready to receive work and field measurements are as shown on drawings and recommended by the manufacturer.

B. Beginning of installation means installer accepts existing substrate.

3.2 PREPARATION

A. Joint surfaces shall be clean and dry. Remove loose mortar and other material completely with compressed air or by brushing.
   1. Joints to be caulked shall be at least ¼" wide unless specifically specified smaller. At any point where the width of the joint is appreciably less, cut or grind out the joint to that width to assure an adequate volume of sealant along the length of the joint, except at concrete paving joints, those shall remain ⅛" wide as indicated.
   2. Pack with backing material the voids and recesses around metal frames which are deeper than the depth required for caulking. Leave the proper depth for the sealant.
   3. In open joints and where detailed, install rod stock as backing material. Roll the material into the joints to avoid stretching. The natural thickness of the rod stock shall be approximately twice the thickness of the joint in which it is installed.
   4. In raked masonry joints, apply a bondbreaker strip of polyethylene or masking tape along the bottom of the joints.
   5. Where sealant is to be applied against smooth metal surfaces, wipe these surfaces clean with a suitable ketone solvent immediately prior to caulking.
   6. Particular attention shall be paid to the preparation of horizontal joints in wear surfaces to be filled with sealant. Adjust joint depth to comply with sealant manufacturer's recommendations by malleting down the joint filler or filling in with rod stock as may be required. Joints in concrete paving shall be primed in accordance with manufacturer’s recommendations.
   7. Perform preparation in accordance with ASTM C 1193 for solvent release sealants, C 1193 for latex base sealants, C 919 for acoustical applications, and C 1193 for elastomeric sealants.

3.3 APPLICATION

A. Priming: Prime porous joint surfaces, particularly masonry and concrete. Test the primer to make sure it causes no staining of the material on which it is applied.

B. Depth of sealant: Seal joints to a depth of approximately ½ the joint width, but never less than ¼" deep. Follow the sealant manufacturer's recommendations where possible.

C. Apply the sealant in accordance with the manufacturer's instructions.
   1. Force the sealant into joints with enough pressure to expel all air and provide a solid filling. Correct any flowing or sagging before final inspection is made.
   2. Where adjacent surfaces permit, use masking tape to obtain straight, even lines. Remove tape immediately after the joints have been sealed.
   3. Fill joints flush with adjacent surfaces except where a recessed joint is specifically detailed. Tool beads with a sled runner or similar tool to insure full contact with joint faces.
   4. For caulking horizontal joints in wear surfaces, use a gun with a narrow nozzle. Apply the flow type sealant with the nozzle riding along the bottom so that the sealant is forced up to completely fill the slot without cavities. Provide and use a portable vacuum cleaner to remove loose dirt from the joints just ahead of the caulking gun.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

E. Tool joints concave. Sealant shall achieve a firm skin before surface coating is applied.

3.4 CLEANING/REPAIRING

A. Clean adjacent surfaces of soiling due to caulking operations. This applicator shall be responsible for and shall bear the cost of replacing any material damaged or discolored due to caulking operations.

B. Repair or replace defaced or disfigured finishes caused by work of this section.

3.5 SEALANT SCHEDULE

A. Locations specified below for sealants and caulking required under this section are general and shall not be considered as affecting the required use of sealing compounds specified under other sections of the specifications.

SEALANT TYPE	APPLICATION
1	a. Vertical control and expansion joints in exterior and unpainted interior masonry surfaces. b. Vertical joints at perimeter of window, door, and storefront elements where adjacent to stone, masonry, or concrete surfaces. c. Reglets: The top groove along the surface-mounted flashing reglets. d. Sealing joints in sheet metal fabrications. e. Unless noted otherwise, any other exterior vertical joints.
2	a. Interior horizontal control and expansion joints in concrete slab-on-grade, flooring, stone, masonry and tile flooring and at junctures between these materials and other adjacent materials.
3	a. Exterior horizontal control and expansion joints in concrete paving**.**
4	a. Sealing of joints between plumbing fixtures and substrates b. Threshold set in full bed of sealant.
5	a. General caulking as part of interior painting in joints subject to movement.
6	a. Sealing joints between countertops and substrates in concession areas and elsewhere which may be in contact with food.
7	a. General caulking as part of interior painting.

END OF SECTION

SECTION 08 11 00

HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hollow metal doors and frames.

B. Related Sections:
1. Section 08 71 00 - Door Hardware: hardware locations.
2. Section 09 91 00 - Painting: finishing of hollow metal doors and frames.

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
1. Include door sizes, construction, frame types, wall anchors, and accessories required for installation.

1.3 QUALITY ASSURANCE

A. Standard: Provide steel doors and frames complying with the Steel Door Institute ANSI/SDI A250.8 and as herein specified. Hollow metal provider that is not a member of the Steel Door Institute is not approved and must submit product data and samples for review.

B. Conform to requirements of ANSI/SDI A250.8.

C. Installed frame and door assembly to conform to UL 10C for fire-rated class indicated or scheduled.

D. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver metal doors and frames to the project site with no dents or open seams and store upright in a protected dry area. Provide packaging and wrapping to protect hollow metal items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide steel doors and frames as manufactured by one of the following:
Ceco Door Products; an ASSA ABLOY Group Co.
Curries Company; an ASSA ABLOY Group Co.
Deansteel Mfg., Inc.
Mesker Door, Inc.
Republic Builders Products Co.
Steelcraft; an Ingersoll-Rand Co.

2.2 MATERIALS

A. Sheet and Strip: ASTM A 1008, commercial quality, leveled, cold-rolled steel free of scale and other surface defects.

2.3 FABRICATION

A. Flush Steel Doors: Full flush type of welded seamless construction with no visible seams or joints on faces or vertical edges.
   1. Exterior Doors:
      a. Extra Heavy Duty; 0.053” thick metallic-coated steel sheet faces (16 ga.); SDI A250.8 Level 3; SDI A250.4 Performance Level A; Edge Construction Model 2 Seamless.
      b. Provide foamed-in-place polyurethane insulation with minimum U-value of 0.60 for assembly with frame.
      c. Face: Metallic-coated steel sheet, with minimum A60 coating.
   2. Interior Doors:
      a. Heavy Duty; 0.042” thick uncoated steel sheet faces (18 ga.); SDI A250.8 Level 2; SDI A250.4 Performance Level B; Edge Construction Model 2 Seamless.
      b. Steel reinforced, stiffened and sound-deadened by laminating to small cell impregnated kraft honeycomb core completely filling the door.
   3. Steel thickness is thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
   4. Steel reinforced, stiffened and sound-deadened by laminating to small cell impregnated kraft honeycomb core completely filling the door or by formed steel vertical stiffeners spaced 6" o.c. and attached to face sheets by spot welds and with the spaces between stiffeners filled with inorganic blanket insulation material.
   5. Continuous vertical interlocking joints on lock and hinge edges with seams continuously welded, filled and dressed smooth. Bevel vertical edges.
   6. Top and bottom edges closed with continuous recessed steel channels spot welded to both faces. Top edge of exterior doors sealed flush with closing channel to exclude water.

B. Steel Frames: Combination buck, frame and trim type. Provide frames with face width, throat opening, backbend, and jamb depth as per dimensions shown.
   1. Exterior Frames:
      a. Extra Heavy Duty; 0.067” thick metallic-coated steel sheet (14 ga.); SDI A250.8 Level 3; SDI A250.4 Performance Level A.
      b. Continuously welded (full profile welded).
      c. Minimum U-value of 0.60 for assembly with door.
      d. Metallic-coated steel sheet with minimum A60 coating.
   2. Interior Frames:
      a. Heavy Duty; 0.053” thick uncoated steel sheet (16 ga.); SDI A250.8 Level 3; SDI A250.4 Performance Level B.
      b. Continuously welded (full profile welded).
   3. Brake-form to profile free of warp, buckles, and fractures with corners square and sharp. Form stop integral with frame except where detailed otherwise. Dress sheared edges straight and smooth.
   4. Close corner joints tight with trim faces mitered and continuously welded. Dress exposed welds flush and smooth.
   5. Loose glazing stops shall be 16 gage steel, mitered corners, fastened with countersunk flathead screws. Fabricate stops to receive vinyl gaskets.
   6. Weld 14 gage steel floor anchors inside each jamb with two holes each anchor for floor anchor bolts.
   7. Furnish frames with steel spreader temporarily fastened to the feet of both jambs for rigidity during shipping and handling.
   8. For each jamb in masonry construction provide 3 or more 16 gage adjustable jamb anchors of the T-strap type spaced not more than 30" apart. Furnish yoke type Underwriters anchors for labeled door openings only.

C. Shop Finish: After fabrication, doors and frames shall be degreased, phosphatized, and factory painted inside and out with a rust inhibitive synthetic primer. Apply mineral filler to eliminate weld scars and other blemishes.

D. Fabricate frames and doors with hardware reinforcement plates welded in place. Provide mortar guard boxes.

E. Reinforce frames wider than 48" with roll formed steel channels fitted tightly into frame head, flush with top.

F. Prepare frame for silencers. Provide three single rubber silencers for single doors and mullions of double doors on strike side, and two single silencers on frame head at double doors without mullions.

G. Close top edge of exterior door flush with inverted steel channel closure. Seal joints watertight.

H. Fabricate frames for masonry wall coursing with 2" head member.

2.4 HARDWARE PREPARATION

A. Prepare doors and door frames for hardware. Mortising, reinforcing, drilling, and tapping shall be done at the factory for mortised hardware. Reinforcement shall be provided for surface-applied hardware, and the drilling and tapping for this hardware shall be done in the field. Provide plaster guards for hinge and strike reinforcements and cutouts on frames.

B. Reinforcement plates in doors and frames for hardware shall be 7 gage for hinges and 12 gage for all other hardware.

C. Punch for and install rubber silencers on all interior hollow metal door frames. Furnish 3 silencers for each single door and 2 silencers for each pair of doors. Set out and adjust strikes to provide clearance for the silencers. Omit silencers on exterior door frames.

2.5 CLEARANCES

A. Doors shall have pre-fit clearances of:
1. At Head and Lock Stile: 1/8".
2. At Hinge Stile: 1/16".
3. At Door Sill:
a. Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
b. With Threshold: 1/8" from bottom of door to top of threshold.
4. Between meeting edges of pair of doors: 1/8".

2.6 ACCESSORIES

A. Rubber Silencers: Resilient rubber.

B. Anchors: Three per jamb, typically, of type to suit supportive construction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify surfaces and conditions are ready to receive work of this section. Notify Architect of any existing conditions which will adversely affect execution. Beginning of execution will constitute acceptance of existing conditions.

3.2 INSTALLATION

A. Install frames in accordance with SDI-105.

B. Install doors in accordance with DHI.

C. Coordinate with masonry construction for anchor placement.

D. Install doors accurately in frames, maintaining specified clearances.

E. Setting Frames:
1. Check frames for rack, twist and out-of-square, and correct.
2. Set frames accurately to maintain scheduled dimensions, hold head level and maintain jambs plumb and square.
3. Anchor frames securely to adjacent construction. Anchor to floor at each jamb with two bolts to prevent twist.
4. Leave spreader bars in place until frames have been permanently built into the walls.

F. Hanging Doors:
   1. Fit and hang the doors to maintain specified door clearances. Metal hinge shims are acceptable to maintain clearances.
   2. Doors shall be out of wind and shall operate smoothly and quietly after adjustment.

3.3 TOLERANCES

A. Maximum Diagonal Distortion: 1/8" measured with straight edge, corner to corner.

END OF SECTION

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SECTION 08 14 23

PLASTIC-LAMINATE-FACED WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Solid core plastic-faced wood doors.
2. Fire-rated plastic-faced wood doors.

B. Related Sections:
1. Section 06 40 00 - Architectural Woodwork: laminate clad cabinets.
2. Section 08 11 00 - Hollow Metal Doors and Frames: hollow metal frames.
3. Section 08 71 00 - Door Hardware: location of hardware.
4. Section 08 80 00 - Glazing: glass for doors.
5. Section 12 32 16 - Manufactured Plastic-laminate-clad Casework

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Indicate sizes, construction, core materials, edge banding dimensions and stop profile.

C. Product Data: Indicate door core materials and construction; type and characteristics.

D. Samples:
1. Submit a sample, 6" by 6", of each plastic laminate finish and color selected.
2. Submit a 12" x 12" sample of solid core door panel indicating construction, core, face and edge detail.
3. Submit 8-1/2" x 11" paint color samples of door glazing frame paint.

E. Certificates: Submit certification that doors comply with reference standards fabrication requirements, signed by authorized representative of door manufacturer.

1.3 QUALITY ASSURANCE

A. Standard: Comply with the requirements of "Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program" as published by Architectural Woodwork Institute.

B. Fire-Rated Wood Doors: Provide plastic faced wood doors which are identical in materials and construction to units tested in door and frame assemblies per NFPA 252 and which are labeled and listed for ratings indicated by UL or Warnock Hersey. Provide metal UL or Warnock Hersey classification markers attached to door.
1. Test Pressure (positive-pressure testing): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.

C. Color Uniformity: Provide plastic laminate for laminate clad millwork, casework, plastic faced wood doors, and plastic laminate toilet compartments from the same manufacturer.

D. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.4 REGULATORY REQUIREMENTS

A. Fire Door Construction: Conform to NFPA 252.

B. Installed Fire-Rated Door Assembly: Conform to NFPA 80 for fire-rated class as scheduled.

1.5 DELIVERY

A. Deliver doors to the project site ready for installation and to receive hardware. Each unit shall be individually plastic wrapped at the factory for protection in transit and storage.

1.6 WARRANTY

A. Special Warranty: Provide Life-of-Installation warranty on manufacturer's standard form, signed by manufacturer, installer, and contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section. Warranty shall specifically include installation of replacement doors required during term of the warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide plastic laminate faced wood doors as manufactured by one of the following:

Marshfield-Algoma (Masonite Architectural)

Oregon Door

VT Industries, Inc./Eggers Industries, Architectural Door Div.

2.2 MATERIALS AND FABRICATION

A. Flush Doors: Premium Grade, PC-HPDL-3 (3-ply), as defined in Section 9 of AWI Quality Standards.
   1. Core: Particleboard meeting ANSI A 208.1, Grade LD-2, Urea-Formaldehyde Free.
   2. Stiles: Vertical edges at least 1-1/8" and bonded to core. Species shall be closed grain hardwood with factory-painted finish to match faces. At doors with wood-look plastic laminate faces, stain vertical edges to match faces.
   3. Rails: Top and bottom rail edges at least 1-1/8" and bonded to core. Mill option.
   4. Dutch doors: Finish faces, all four edges, edges of cutouts, and mortises. Do not omit laminate finish on top and bottom edges.
   5. Faces: HGS (nominal 0.048") high pressure decorative laminated plastic conforming to NEMA LD 3. Laminate to be bonded to both faces. Fire-rated plastic laminate faced wood doors shall be surfaced with fire-rated (UL Stamped) laminated plastic sheet. Color shall be as selected by Architect from manufacturer's full color and pattern range. Product/manufacturer; one of the following:
      Formica Brand Laminate; Formica Corp.
      Pionite or Nevamar; Panolam Industries
      Wilsonart; Wilsonart LLC
   6. Stops: Provide shop primed metal glazing frames at all light openings. Fasten by through-bolted countersunk flathead screws. Field painted color as selected by Architect.
   7. Louvers: Provide factory installed, inverted "V" or "Y" sightproof type fixed louvers. Furnish with standard factory baked enamel finish.

B. Labeled Doors:
   1. "B" Label Doors (90-minute and 60-minute): AWI Type FD 1-1/2 or 1 non-combustible solid mineral core with chemically treated hardwood edge banding and fire-retardant cross banding. Pairs of "B Label" doors shall be furnished with necessary metal edge and astragal trim if required by door manufacturer to meet code requirements.
   2. "C" Label Doors: AWI Type FD 3/4 non-combustible solid mineral core with chemically treated hardwood edge banding and fire-retardant cross banding.
   3. 20-Minute Label Doors: AWI Type FD 1/3 solid particleboard core with a 20-Minute Fire Label.
   4. Smoke Control Door Labeling: Smoke control doors shall show the letter "S" on the fire rating label of the door. The marking shall indicate that the door and frame assembly are in compliance when listed or labeled gasketing is also installed.
   5. Cut-outs for vision panels in fire-rated doors shall be factory cut. No field cutting shall be permitted.
   6. Stops: Provide listed shop primed metal glazing frames at all light openings. Fasten by through-bolted countersunk flathead screws. Field painted color as selected by Architect.

C. Fitting:
   1. Cutouts for mortise hardware shall be made to template at the factory.
   2. Top and bottom rail edges and core exposed by cutouts for hardware shall be factory sealed.
   3. Doors shall have pre-fit clearances of:
      a. At Head and Lock Stile: 1/8"
      b. At Hinge Stile: 1/16"
      c. At Door Sill:
         1) Without Threshold: 1/8" from bottom of door to top of decorative floor finish or covering.
         2) With Threshold: 1/8" from bottom of door to top of threshold.
      d. Between meeting edges of pair of doors: 1/8"
   4. Fitting Clearances for Fire-Rated Doors: Comply with NFPA 80. Bevel fire-rated doors 1/8" in 2" in lock edge.

2.3 ADHESIVE

A. Facing Adhesive: Type I - waterproof.

2.4 FABRICATION

A. Fabricate non-rated doors in accordance with AWI Quality Standards requirements.

B. Fabricate fire-rated doors in accordance with AWI Quality Standards and to UL or Warnock-Hersey requirements. Attach fire-rating label to door.

C. Provide lock blocks at lock edge and top of door for closer for hardware reinforcement.

D. Fit door metal edge trim to edge of stiles after applying veneer facing.

E. Bond edge banding to cores.

F. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Provide solid blocking for through-bolted hardware.

G. Factory pre-fit doors for frame opening dimensions identified on shop drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify frame opening conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 PREPARATION

A. Condition plastic faced wood doors to the average prevailing humidity in the building prior to fitting and hanging.

3.3 INSTALLATION

A. General: Installation of doors shall comply with the applicable requirements of Section 1700 Installation of Architectural Woodwork (Interior) of the AWI Quality Standards.

B. Hang doors to maintain uniform clearances. Doors shall be out of wind and shall operate smoothly and quietly after adjustment. Replace doors damaged during installation.

C. Cutting and fitting of plastic laminate faced doors at the project site will not be permitted. Doors which do not fit properly shall be replaced.

D. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80. Trim stiles and rails of fire-rated doors only to extent permitted by labeling agency.

E. Pilot drill screw and bolt holes.

F. Machine cut for hardware. Core for handsets and cylinders.

G. Coordinate installation of doors with installation of frames specified in SECTION 08 11 00 - HOLLOW METAL DOORS AND FRAMES and hardware specified in SECTION 08 71 00 - DOOR HARDWARE.

H. Coordinate installation of glass and glazing.

3.4 INSTALLATION TOLERANCES

A. Conform to AWI requirements for fit and clearance tolerances.

B. Maximum Diagonal Distortion (Warp): 1/8" measured with straight edge or taut string, corner to corner, over an imaginary 36" x 84" surface area.

C. Maximum Vertical Distortion (Bow): 1/8" measured with straight edge or taut string, top to bottom, over an imaginary 36" x 84" surface area.

D. Maximum Width Distortion (Cup): 1/8" measured with straight edge or taut string, edge to edge, over an imaginary 36" x 84" surface area.

3.5 ADJUSTING

A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Adjust door for smooth and balanced door movement.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Wall and ceiling access doors.

B. Related Sections
1. Section 03 30 00 - Cast-In-Place Concrete: Openings in concrete.
2. Section 04 20 00 - Masonry Units: Openings in masonry.
3. Section 09 21 16 - Gypsum Board Assemblies: Openings in gypsum board walls and ceilings.
4. Section 09 30 00 - Tiling.
5. Section 09 91 00 - Painting: Field paint finish.
6. Division 22 - Plumbing components requiring access.
7. Division 23 - Mechanical components requiring access.
8. Division 26 - Electrical components requiring access.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's installation instructions.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with UL requirements for fire-rated doors.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable code for fire-rated access units.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as instructed by the manufacturer.

1.6 COORDINATION

A. Coordinate work under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Coordinate the work with mechanical and electrical work requiring access units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide wall and ceiling access doors as manufactured by one of the following:
J.L. Industries, Inc.
Karp Associates, Inc.
Larsen’s Mfg. Co.
Milcor Limited Partnership
Nystrom Building Products Co.

2.2 GENERAL

A. Flush metal panel access doors.

B. Size: As required for ease of access, but not less than 12" x 12".

C. Material:
   1. Model M3202: Painted steel 14 gauge frame and door.
   2. Model MS3202: Stainless steel 16 gauge frame and door.
   3. Models DW3203 and K3200: Painted steel 16 gauge frame; 14 gauge door.
   4. Model ATR3204: Painted steel 16 gauge frame; 18 gauge door.
   5. Fire-Rated Model 3218: Painted and stainless steel 14 gauge frame; 20 gauge door.

D. Lock: Screwdriver operated, with metal cam.

2.3 ACCESS UNITS - WALLS

A. Non-Fire-Rated Door and Frame Unit:
   1. In Cast-in-Place Concrete: Model M3202 (painted) manufactured by Milcor.
   2. In Masonry: Model M3202 (painted) manufactured by Milcor.
   3. In Ceramic Tile on Gypsum Board on Steel Studs: Model MS3202 (stainless steel) manufactured by Milcor.
   4. In Gypsum Board on Steel Studs: Model DW3203 (painted) manufactured by Milcor.
   5. In Plaster on Metal Furring: Model K3200 (painted) manufactured by Milcor.

2.4 ACCESS UNITS - CEILINGS

A. Non-Fire-Rated Door and Frame Unit:
   1. In Gypsum Board on Metal Furring: Model DW 3203 manufactured by Milcor.
   2. In Plaster on Metal Furring: Model K3200 manufactured by Milcor.
   3. In Metal T-Bar Ceiling: Model ATR 3204 manufactured by Milcor.

2.5 FINISHES

A. Painted Finish: One coat baked enamel primer with baked enamel finish, color as selected by Architect.

B. Stainless Steel: No. 4 finish.

C. Aluminum: Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate conditions under provisions of SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.

B. Verify that rough openings for door and frame are correctly sized and located.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions and recommendations.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Position unit to provide convenient access to concealed work requiring access.

END OF SECTION

SECTION 08 33 13

COILING COUNTER DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Coiling counter doors.

B. Related Sections:
   1. Section 08 71 00 - Door Hardware: cylinders for coiling door lock and key switch.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

B. Product Data: Submit manufacturer's product data and installation instructions for each type of coiling counter door. Include both published data and any specific data prepared for this project.

C. Shop Drawings: Submit shop drawings for approval prior to fabrication. Include detailed plans, elevations, details of framing members, required clearances, anchors and accessories. Include relationship with adjacent materials.

1.3 QUALITY ASSURANCE

A. Labeled Construction: Door and frame shall be manufactured in accordance with specifications and procedures for doors and frames tested and rated by Underwriter's Laboratories, Inc. Metal UL classification markers shall be attached to door and frame.

1.4 WARRANTY

A. Manufacturer's 2 year limited warranty for PowderGuard Premium Powder Coat Finish.

PART 2 - PRODUCTS

2.1 COILING COUNTER DOORS

A. Face-of-Wall Mounted coiling door to detail. Product/manufacturer; one of the following:
   ESC10; Cornell/Cookson, LLC.
   DuraShutter Standard; Raynor
   650 Series; Overhead Door Corp.
   Model 500; Wayne-Dalton Commercial Rolling Doors; Div. Overhead Door Corp.

B. Curtain: Interlocking slats, similar to Overhead Door Flat Type F-128 fabricated of 22 gauge galvanized steel. Endlocks attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.

C. Bottom Bar: Single primed steel angle bottom bar with weatherstrip.

D. Guides: 11-gauge roll-formed steel guides with PowderGuard finish to match slats.

E. Roller Shaft: Steel pipe with cast iron end plugs and containing an oil tempered, helical counterbalancing steel spring with external adjustment by means of a wheel.

F. Brackets: Heavy cast iron or steel designed to form end closure supports for the hood. Roller shaft ends shall be journaled into bracket hubs and fitted with self-lubricating bronze bearings or sealed ball bearings.

G. Hood: Provided with intermediate support brackets as required and fabricated of galvanized steel. Finish and color to match curtain.

H. Operation: Door shall be counterbalanced for ease of manual push-up operation.

I. Locking: Provide cylinder locks on bottom bar less cylinder for key operation. Cylinder locking for motor operated doors to include electrical interlock to prevent operation before door is unlocked.

J. Finish:
   1. Galvanized Surfaces:
      a. Base Coat: ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat.
      b. Finish Coat: Zirconium treatment followed by baked-on polyester powder coat, with color as scheduled in MATERIAL FINISH SCHEDULE in drawings; minimum 2.5 mils cured film thickness; ASTM D-3363 pencil hardness: H or better.
   2. Ungalvanized Surfaces: Shop coat of rust inhibiting metallic primer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coiling counter door shall be installed by skilled mechanics supervised by the manufacturer's authorized representative.

B. Erect the door, guides, and accessories in a rigid substantial manner, straight and plumb, and with horizontal lines level.

3.2 ADJUSTING

A. Adjust the door and operators and leave in good working order.

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

Section Includes:

1. Coiling doors.

Related Sections:

2. Section 05 50 00 - Metal Fabrications: steel frames for coiling door openings.
3. Section 08 71 00 - Door Hardware: cylinders.

1.2 SUBMITTALS

Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include installation details and operating procedures.

1.3 QUALITY ASSURANCE

Wind Load: Exterior coiling doors shall be constructed to safely resist uniform pressure (velocity pressure) of 43.8 psf.

Labeled Construction: Doors required by schedule to be labeled shall be manufactured in accordance with specifications and procedures for doors tested and rated by Underwriter's Laboratories, Inc. Metal UL classification markers shall be attached to these doors.

PART 2 - PRODUCTS

2.1 INSULATED COILING DOORS

A. Provide face-of-wall mounted insulated coiling door. Product/manufacturer; one of the following:
   Thermiser/ESD20; Cornell/Cookson, LLC.
   625 Series Stormtite Service Doors; Overhead Door Corp.
   1. Operation: Motor operator.
      a. Motor:
         1) Provide high starting torque motor, including motor cover, of the size and design as recommended by door manufacturer, reduction gearing, solenoid brake, limit switches, emergency hand chain with electrical interlock, magnetic relay contactor, overload protection, prewiring to terminal block, stoplock safety bearing to prevent doors from falling in event of motor damage.
         2) 208 V, 3 phase, 60 Hz.
         3) Provide key operated control switch.
         4) Motor operator shall be equipped with electric safety edge with cable reel in conjunction with the door operator control.
   2. Curtains:
      a. Flat-faced, insulated, interlocking slats cold roll formed of galvanized steel.
      b. End of alternate slats to be fitted with malleable iron endlocks.
      c. Slat design shall satisfy a windload of 20 psf.
      d. Curtain to be reinforced with bottom bar consisting of two angles of galvanized steel. Install weatherseal on bottom of bars.
      e. Polyurethane insulation with minimum R-value of 7.7.
      f. Backing slats of galvanized steel.
      g. Air infiltration to comply with IECC 2015 requirements of less than 1.0 CFM/FT2.
   3. Spring Counterbalance:
      a. House in steel pipe of diameter and wall thickness to restrict maximum deflection to 0.03" per foot of door width.
      b. Springs to be helical torsion type.
      c. Spring tension to be adjustable by means of external adjustment wheel.
   4. Bracket Plates: ¼" thick min. steel formed to fit contour of end bracket.
   5. Guides:
      a. Structural galvanized steel angles of 3/16" min. thickness.
      b. Fit guides with two flexible weathering strips (both sides).
   6. Hoods:
      a. Fabricated of galvanized steel sheet metal no lighter than 24 gage, laterally reinforced.
      b. Provide intermediate hood supports for hoods exceeding 16'-0".
      c. Fit with internal neoprene header weather baffle.

7. Locks:
   a. Provide cylinder locks on bottom bars less standard cylinder for key operation. Cylinder locking for motor operated doors to include electrical interlock to prevent operation before door is unlocked.
8. Finish:
   a. Galvanized Surfaces:
      1) Base Coat: ASTM A 653 galvanized base coating treated with dual process rinsing agents in preparation for chemical bonding, gray baked-on base coat and gray baked-on polyester finish coat.
      2) Finish Coat: Zirconium treatment followed by baked-on polyester powder coat, color as scheduled in MATERIAL FINISH SCHEDULE in drawings, 2.5 mils cured film thickness; ASTM D-3363 pencil hardness: H or better.
9. Weatherstripping: Door to be fully weatherstripped at sill, hood, and at guides.

PART 3 - EXECUTION

3.1 INSTALLATION

Coiling doors shall be installed by skilled mechanics supervised by the manufacturer's authorized representative.

Erect the doors, guides, and accessories in a rigid substantial manner, straight and plumb, and with horizontal lines level.

3.2 TESTING AND ADJUSTING

Upon completion of installation, put all items through at least ten operating cycles. Make required adjustments and assure that components are in optimum operating condition.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum entrance and storefront systems with associated aluminum doors.

B. Related Sections:
1. Section 07 92 00 - Joint Sealants: caulking of perimeter joints.
2. Section 08 80 00 - Glazing.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Include drawings showing elevations of each entrance and storefront type, detail sections of typical composite members, and glazing details.

C. Samples: Submit for approval duplicate samples showing the limits of color range to which the entrance, storefront, and door materials will be processed. Samples shall be representative of the materials to be furnished, and the color of the installed materials shall be within the range of the approved samples.

D. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

1.3 SYSTEM DESCRIPTION AND PERFORMANCE

A. Architectural Requirements
1. Drawings are diagrammatic and do not purport to identify or solve problems of thermal or structural movement, glazing or anchorage.
2. Requirements shown by details are intended to establish basic dimensions of units, sightlines and profiles of members.
3. Provide concealed fastening wherever possible.
4. Provide continuous snap-in thermally-broken aluminum backer plate at head and jamb conditions.

B. Structural Requirements
1. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170°F. without causing detrimental effects to system or components.
2. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ANSI/ASTM E 330.
3. Limit mullion deflection to L/175, or flexure limit of glass with full recovery of glazing materials, whichever is less.
4. System to accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.
5. Storefront manufacturer shall be responsible for design and engineering of storefront system, including necessary modifications to meet specified requirements and maintaining visual design concepts.
6. Attachment considerations shall take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
7. Design anchors, fasteners and braces to be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
8. Engineer storefront and entrances to be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.

C. Environmental Requirements
1. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior. No leakage shall occur in wall when tested in accordance with ASTM E 331 at test pressure of 6.24 lbs/sq ft.

2. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of assembly surface area, measured at a reference differential pressure across assembly of 1.57 lbs/sq ft. as measured in accordance with ANSI/ASTM E 283.
3. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

1.4 QUALITY ASSURANCE

A. Erector Qualifications: Erection of the entrance and storefront systems and doors shall be by an experienced erector approved by the manufacturer.

B. Design Criteria:
1. Deflection of glass framing members under design loads shall not exceed L/175 or ¾", whichever is less.
2. Deadload deflection of horizontal glass framing members shall not exceed 0.125".
3. Exterior Entrances and Storefront: Design windload shall be 22 psf.

C. Perform work in accordance with AAMA SFM-1 and AAMA - Metal Curtain Wall, Window, Store Front and Entrance - Guide Specifications Manual.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle system components under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.

B. Store and protect system components under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

C. Provide wrapping to protect prefinished aluminum surfaces.

1.6 COORDINATION

A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings required field measurements beyond his control.

B. Coordinate with responsible trades to establish, verify and maintain field dimensions and job conditions.

1.7 ENVIRONMENTAL CONDITIONS

A. Do not install sealants when ambient temperature is less than 40°F. during and 48-hours after installation.

1.8 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 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, metal finishes, and other materials beyond normal weathering.
   d. Water leakage through fixed glazing and framing areas.
   e. Failure or operating components to function properly.
2. Warranty Period: 2 years from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide aluminum storefronts as manufactured by one of the following:
EFCO Corp.
Kawneer North America
Oldcastle Building Envelope
Tubelite, Inc
YKK AP America, Inc.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B 221; AA 6063-T5 alloy, temper.

B. Sheet Aluminum: ASTM B 209; 5005-H34 alloy, temper; or other alloys and temper recommend by manufacturer appropriate for specified finish.

C. Sheet Steel: ASTM A 446; hot-dipped galvanized.

D. Steel Sections: ASTM A 36; shapes to suit mullion sections.

E. Primer and Touch-Up Primer for Galvanized Surfaces: High-zinc-dust-content paint complying with SSPC-Paint 20.

F. Fasteners: Stainless steel.

2.3 FABRICATED COMPONENTS

A. General: Form section true to details with clean, straight, sharply defined profiles, free from defects impairing strength or durability.

B. Framing:
1. Framing Types Basis of Design shall be Kawneer:
   a. Exterior: Provide the following thermally broken framing systems where shown on drawings.
      1) 2” x 4-1/2” Framing System: Kawneer Trifab® VG ™ 451T
2. Fabricate the aluminum storefront systems with the shapes and sections detailed.
3. Design the glass framing system to minimize loads on the glass due to building movement and incorporate provisions for thermal expansion by means of expansion joints. Where insulating glass is to be installed, design the glass framing system so that moisture does not accumulate in the glazing channel for prolonged periods.
4. Construction: Mill joints to a hairline fit. Assemble and connect members to form rigid, watertight assemblies. No exposed fastenings will be permitted. Reinforce the framing internally as required to meet the design criteria specified above.
5. Continuous Solid Closures: Fabricate required closures and covers to detail of aluminum sheet, plate, and angles. Provide solid continuous thermally-broken backer plate closures at head and all jambs.
6. Accessories: Provide glazing gaskets, flashing, and miscellaneous shims and other parts detailed or otherwise required to complete the work.
7. Provide manufacturer's standard closure plate at perimeter framing members to cover open side of framing member against surrounding construction. Provide solid aluminum head channel at head condition per drawings.

C. Doors: Kawneer 500 Heavy Wall Doors and Heavy Wall Framing System. The aluminum doors shall be wide-stile type with 6" stiles, 8" top rail, 8" intermediate rail (centered on panic device) and 10¼" bottom rail; square glazing stops. Construction: Doors shall be mortised and have reinforced welded corner construction with hairline watertight joints. Fastenings shall be concealed.
1. Doors shall be factory fabricated by aluminum entrance and storefront manufacturer.
2. Glazing Beads: Fixed or theft proof snap-in glazing beads on exterior or security side of doors. Interior glazing beads shall be snap-in type. All glazing beads shall have vinyl inserts and glazing gaskets.
3. Weatherstripping: Continuous contact weatherstripping on stiles and top rails of exterior doors.

D. Hardware Preparation: Prepare and reinforce doors and door frames for hardware.
   1. Mortising, reinforcing, drilling, and tapping for mortised hardware shall be done at the factory.
   2. Wherever possible, concealed steel reinforcement for surface-applied hardware shall be installed at the factory. The drilling and tapping for surface-applied hardware shall be done in the field.

E. Reinforced Mullion: Same profile as non-reinforced frames, of extruded aluminum cladding with internal reinforcement of steel shaped structural section.

F. Flashings:
   1. Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oilcanning"; of proper alloy to match the finished extrusions.
   2. Subsill Flashing: Provide manufacturer's standard high-performance, thermally-broken aluminum subsill flashing with integral weep holes. End dams shall be manufacturer's standard fiberglass, plastic or thermally-broken aluminum end dams.

G. Extruded Aluminum:
   1. Framing System: Principal extrusions shall have a minimum wall thickness of 0.08". Moldings, trim, and glass stops shall be not less than 0.050" thick.
   2. Doors and Door Framing System: Principal extrusions shall have a minimum wall thickness of 3/16". Moldings, trim, and glass stops shall be not less than 0.050" thick.

H. Reinforcement: Concealed reinforcements for hardware in frames and mullions shall be plated or galvanized steel and shall be secured in place.

I. Fabricate frames allowing for minimum clearances and shim spacing around perimeter of assembly, yet enabling installation.

J. Rigidly fit and secure joints and corners with internal reinforcement, except that door corners will be welded. Make joints and connections flush, hairline, and weatherproof.

K. Develop drainage holes with moisture pattern to exterior.

L. Prepare components to receive anchor devices. Fabricate anchorage items.

M. Arrange fasteners, attachments, and jointing to ensure concealment from view.

N. Reinforce framing members for imposed loads.

2.4 HARDWARE

A. Weatherstripping: Provide Kawneer's Polymeric Sealair Weathering System or approved equivalent, continuous at head, jamb, sill, and meeting stile

B. Refer to SECTION 08 71 00 - DOOR HARDWARE for balance of hardware.

2.5 FINISHES

A. Finish coating to conform to AAMA 611.

B. Aluminum Finish: Exposed aluminum surfaces of storefronts and all their associated parts shall be Architectural Class I AA-M10C22A41 Clear Anodic Coating, .7 mil minimum. Screw and bolt heads exposed to view shall be finished to match the exposed aluminum surfaces.

C. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A 123 to 2.0 oz/sq ft.

D. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive storefronts for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

B. Field check dimensions, elevations, and slopes on the connecting work affecting the entrance and storefront to assure a proper fit and weathertight installation.

C. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

3.2 INSTALLATION

A. Erecting Storefronts: Erect the members to be plumb, level, square and in proper alignment with other work, and free from sags, waves and buckles.
   1. Materials shall be accurately cut and fitted and rigidly anchored in place to resist safely all normal stresses to which the work will be subjected.
   2. Cut and machined ends and recesses shall be true, accurate and free of burrs and rough edges.
   3. Provide subsill extrusions positioned to collect water leakage through mullions and storefront. Subsill shall drain to the exterior. It shall run continuously across the opening width. The ends are sealed with end dams.
   4. Create end dams at ends of window heads, sills, at edges of storefronts, and other vertical elements to channel water to nearest weep hole away from window mullions and other items which might allow water to travel vertically.
   5. Provide clearance around the perimeter between storefront metal and the opening substrate (masonry) for caulking.

B. Sealing Joints: Seal the metal-to-metal framing joints properly in conformance with the manufacturer's standard procedure.

C. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

D. Install glass in accordance with SECTION 08 80 00 - GLAZING, using exterior dry method of glazing.

E. Install perimeter 2 part polyurethane type sealant, backing materials, and installation requirements in accordance with SECTION 07 92 00 - JOINT SEALANTS.

3.3 TOLERANCES

A. Maximum Variation from Plumb: 0.06" every 3' non-cumulative or 1/16" per 10', whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32".

3.4 ADJUSTING

A. Adjust operating hardware for smooth operation.

3.5 PROTECT AND CLEAN

A. Protection of Aluminum:
   1. Protect concealed aluminum surfaces that will contact masonry and steel with neoprene gaskets or a coat of bituminous paint to prevent galvanic and corrosive action.
   2. If drainage of moisture from incompatible metal passes over aluminum, paint the incompatible metal with a coat of aluminum pigmented paint.
   3. Protect finished aluminum surfaces from staining by gypsum and cement materials until all adjacent masonry and plaster work has been completed.

B. Cleaning: Upon completion of the work, wash down aluminum surfaces with water and soft cloths and leave in first class condition.

END OF SECTION

SECTION 08 51 16

PASS WINDOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum sliding, horizontal and vertical types, transaction window complete with hardware and related components.

B. Related Sections:
   1. Section 07 92 00 - Joint Sealants: Perimeter sealant and back-up materials.

1.2 SUBMITTALS

A. Submit in accordance with SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data:
   1. Details on fabrication, finishing, glazing, accessories, and other components of work.
   2. Manufacturer's recommended maintenance procedures.
   3. Hardware and operators.

C. Shop Drawings: Submit drawings for fabrication of window units and associated components of work of manufacturer's standard, elevation of window type, detail section of typical members, wall anchors and accessories required for installation.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

A. Perform work in accordance with AAMA 101.

B. Manufacturer and Installer: Company specializing in manufacturing aluminum windows with minimum three years documented experience.

C. Erector Qualifications: Erection of the aluminum windows shall be by an experienced erector approved by the manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of SECTION 01610 - TRANSPORTATION AND HANDLING and SECTION 01620 - STORAGE AND PROTECTION.

B. Protect pre-finished aluminum surfaces with wrapping or strippable coating. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

C. Store windows in upright position, off ground.

D. Protect from weather and damage.

E. Store in protected dry area. Place units on wood skids and store in manner that will prevent rust and damage. Avoid use of non-vented plastic or canvas coverings which could trap moisture.

1.5 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Horizontal Sliding Transaction Window and Concessions 225: Provide Horizontal Sliding Manual Service Window 4200A series as manufactured by CRL.
   1. Without bottom track.
   2. ¼" laminated glazing.
   3. Jamb latches.

B. Vertical Sliding Transaction Window at Ticket Booth 201: Provide Vertical Sliding Manual Service Window SW1014A as manufactured by CRL.
   1. ¼" laminated glazing.
   2. Jamb latches.

C. Substitutions: Under provisions of SECTION 01630 - PRODUCT OPTIONS AND SUBSTITUTIONS.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B221; 6063 alloy, T6 and T52 temper.

B. Aluminum Sheet: ASTM B 209, Allow 5005-AQ-H34.

C. Galvanized Steel Sheet: ASTM A653, G90

D. Glass: 1/4" thick clear laminated glass.

E. Fasteners:
   1. Manufacturer's standard non-corrosive fasteners, compatible with aluminum window members, trim, hardware, anchors and other components of window units.
   2. Provide concealed fasteners wherever possible.
   3. Provide exposed fasteners which match finish of member or hardware being fastened.

F. Hardware: Manufacturer's standard slide lock and and aluminum bar extrusion with sliding spring-loaded locking clip.

G. Weatherstripping: Manufacturer's standard wool pile counter seal, or equivalent.

H. Finish: Clear anodized.

2.3 SEALANT MATERIALS

A. Sealant and Backing Materials: As specified in SECTION 07920 - JOINT SEALANTS of types described below.

B. Sealant Used Within System (Not Used for Glazing): As recommended by manufacturer of window.

2.4 FABRICATION

A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Arrange fasteners and attachments to ensure concealment from view.

E. Prepare components with internal reinforcement for operating hardware.

F. Shop glaze window units unless noted otherwise.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive window for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install the work of this section in strict accordance with the manufacturer's written instructions and recommendations, anchoring all units firmly into position square, plumb, straight and true.

B. Do not install until finishing of concrete, masonry, or other operations harmful to glass are complete.

C. Anchor securely in place in accordance with manufacturer's requirements to maintain fire-rated barrier.

D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances, aligning with adjacent work.

E. Set flange members in bed of sealant by method required to achieve performance criteria and installation criteria in accordance with SECTION 07920 - JOINT SEALANTS.

3.3 ADJUSTING

A. Adjust operating sash and hardware to provide tight fit at contact points and at weatherstripping for smooth operation.

B. Lubricate hardware and moving parts, if necessary.

C. Touch-up marred or abraded surfaces to match original finish.

3.4 CLEANING

A. Prior to completion of the work, thoroughly clean all exposed surfaces of steel and glass.
   1. Use only cleaning materials and techniques recommended by the manufacturer of material being cleaned.
   2. Avoid damage to protective coatings and finishes.
   3. Remove excess glazing and sealant compounds, dirt and other substances.

END OF SECTION

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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 “Door Hardware Schedule”.
2. Division 08 Section “Hollow Metal Doors and Frames”.
3. Division 08 Section “Interior Aluminum Doors and Frames”.
4. Division 08 Section “Plastic Laminate Faced Wood Doors”.

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 installer of Windstorm assemblies.

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 Submittals.

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 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 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 Owner, 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.

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 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 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. Warranty Periods:

1. 10 years mortise locks and latches.
2. Five years for exit hardware.
3. 7 years on cylindrical locks.
4. 5 year for electric latch retraction exit motors
5. Twenty five years for manual surface door closer bodies.
6. 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.

1.9 OWNER STOCK – Provide the following:

20 Construction Cores

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:

C. 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.

D. 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 as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:

    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 where indicated in the Hardware Sets or on Drawings:

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. Acceptable Manufacturers:

a. Hager Companies (HA).
b. McKinney Products (MK).
c. Stanley Hardware (ST).
d. Ives (IV)

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B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. **Only** where specifically requested by Owner.

2. Acceptable Manufacturers:

a. Pemko
b. Ives

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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 10) 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.

Commented [HP3]: 12 not required, only 10 needed for your application

1. Acceptable Manufacturers:

a. Pemko Manufacturing (PE) – EL-CEPT Series.
b. Securitron (SU) - EL-CEPT Series.
c. Stanley Hardware (ST) EPT-12C Series.
d. Von Duprin (VD)– EPT10 Series

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
a. McKinney Products (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney Products (MK) - Connector Hand Tool: QC-R003.
c. Von Duprin, Schlage (VD) SC) – Electrical Connector Kits: CON12 x Length required

2.4 DOOR OPERATING TRIM

A. Flush Bolts : ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.

3. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
4. Automatic flush bolts **ONLY** when specifically requested by owner or required by code (fire rated doors)
5. Acceptable Manufacturers:

    a. Ives (IV).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

B. Door Push Plates and Pulls: ANS/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. Acceptable Manufacturers:

    a. Ives (IV).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

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. Acceptable Manufacturers:

    a. Schlage (SFIC) Everest T 29 Series
    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. Keyway: Match Facility Standard.

D. Locksets and keyways must allow Everest T-29 (Owners pat. key system).

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. Existing System: Key locks to Owner's existing system.

F. Visual Key Control:
   1. Stamp keys and core face with DHI key symbol

G. Visual Core Control:
   1. Stamp on face of core.

H. Key Quantity: Provide the following minimum number of keys:

   1. Change Keys per Cylinder: Two (2)
   2. Master Keys (per Master Key Level/Group): Five (5).
   3. Construction Keys (where required): Ten (10).
   4. Construction Control Keys (where required): Two (2).
   5. Permanent Control Keys (where required): Two (2).

I. Construction Keying: Provide temporary keyed construction cores at exteriors only. Temporary plastic cores at remaining openings.

J. 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 bitting list in written an electronic file as directed by the Owner.

K. 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. Acceptable Manufacturers:

      a. Lund Equipment (LU).
      b. MMF Industries (MM).
      c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

   1. Acceptable Manufacturers

      a. Sargent Manufacturing (SA) 8200 Series (Mortise) (SC) Schlage L9000 Series
         a) Staff Toilet accessible by student V20 8251 (always locked)
         b) Staff Restroom not-accessible by student V20 8265
         c) Student Gang Restroom LC-4878 (shelter in place) (No Sub due to function)

      b. Sargent Manufacturing (SA) 10 line Series (SC) ND Series
         a) Storeroom/Elec/Mech/IDF 10G04 (always locked)
         b) Office 10G05 (push button)
         c) Passage 10U15
         d) Classroom 10G37 (locked or unlocked)
         e) Privacy 10U65 (coin turn)
         f) Public use restroom 10U65 (lock with coin turn outside)
         g) Secure Vestibule 10G71 (fail secure)

2.7 AUXILIARY LOCKS

A. Tubular Deadlocks: Acceptable Manufacturers:

a. Sargent Manufacturing (SA) – 4870 Series. Schlage (SC) L460 Series
a) Student Gang Restroom 4878
b) Locker Room Restroom 4878
c) Serving Line Pair 4875

Commented [HP4]: Took out requirement of same source as locks due to proprietary function.

2.8 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. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Auxiliary Deadlocks: BHMA A156.5.
3. Dustproof Strikes: BHMA A156.16.

2.9 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. Where specified, provide exit devices with cylinder dogging device to hold the push bar and latch in a retracted position. Provide cylinder dogging on devices where specified in Hardware Sets. Provide cylinder dogging at inactive leaf of electrified pairs.

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. 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. (Schlage - RHO)
b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vandal trim at all exteriors with exits.
a. Rockwood vandal trim VRT22/VRT22 CFC
b. Ives VR 910 Vandal Trim VR910 NL/VR910 DT

7. Rail Sizing: Provide exit device rails factory sized for proper door width application.

8. Through Bolt Installation: For all metal doors.

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 steel, pullman type, with deadlock feature.

1. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.
b. Von Duprin (VD) 99 Series

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 wall mounting kits for all keyed removable mullions

4. Provide electrical quick connection wiring options as specified in the hardware sets.

5. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) – L980S Series.
b. Von Duprin (VD) – KR4954/KR9954

2.10 INTEGRATED WIEGAND/RS485 OUTPUT ACCESS CONTROL EXIT DEVICES OR WEIGAND/RS485 EXIT DEVICE TRIM

A. Wiegand Output Integrated Card Reader Exit Hardware: Wiegand output ANSI 156.3 Grade 1 rim, mortise, and vertical rod exit device hardware with integrated or lock installed proximity card reader, latchbolt and touchbar monitoring, and request-to-exit signaling. 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 compatible access control systems. Inside push bar (request-to-exit) signaling and door position (open/closed status) monitoring (via separately connected or integrated DPS).
2. Reader supports either HID 125 kHz proximity (up to 39 bits, including Corporate 1000) or 13.56 MHz (2K-32K) iClass® credentials.
3. 12VDC or 24VDC external power supply required for reader, with optional 24VDC operation available with iClass® reader (125 kHz reader). 24VDC required for solenoid operated exit trim or entire lockset (12VDC if applicable). Fail safe or fail secure options.

4. Acceptable Manufacturers:

a. Sargent Manufacturing (SA) – SE LP10 – M1 80 Series Exits.
Sargent Manufacturing (SA) – SE LP10 - M1 8200 Series Locks.
b. Schlage AD300 Series

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

Commented [HP5]: Took out Stainless Steel requirement. It's proprietary.

Commented [HP6]: Removed home run single cable proprietary requirement.

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. 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.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets and spacers.

7. Through Bolt Installation: For all metal doors , and as requested by owner.

8. Provide cush stop arms (CPS) (CUSH)at all exterior

9. Provide cush stop holder arms (CPSH) (HCUSH) as requested by owner

10. No closers on classrooms, science labs, computer labs, custodial closets, and small rooms.

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. Acceptable Manufacturers:

   a. Sargent Manufacturing (SA) - 351 Series.
   b. LCN (LC) 4050A Series

2.12 SURFACE MOUNTED WALL HOLDERS

A. Electromagnetic Door Holders: Certified ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate.12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Acceptable Manufacturers:

   a. Rixson (RF) - 980/990 Series.
   b. Sargent Manufacturing (SA) - 1560 Series.
   c. LCN (LC) – 7800 Series

Commented [HP7]: Removed proprietary cycle testing.

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. 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.

4. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

5. Acceptable Manufacturers:

    a. Ives (IV).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

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 . Provide dome stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic
    a. No wall mounted stops
    b. Floor stop equall to Rockwood 441CU

2. Acceptable Manufacturers:

    a. Ives (IV).
    b. Rockwood Manufacturing (RO).
    c. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Acceptable Manufacturers:

    a. Only when requested by owner

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 UBC 7-2, Fire Tests of Door Assemblies.

D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

E. Acceptable Manufacturers:

1. National Guard Products (NG).
2. Pemko Manufacturing (PE).
3. Reese Enterprises, Inc. (RE).
4. Zero Manufacturing (ZE)

2.16 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Acceptable Manufacturers:

a. Provided by Security

B. Switching Power Supplies: Provide UL listed or recognized filtered and regulated power supplies. Provide single, dual, or multi-voltage units as shown in the hardware sets. Units must be expandable up to eight Class 2 power limited outputs. Units must include the capability to incorporate a battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

1. Acceptable Manufacturers:

a. Provided by Security

2.17 OPERATING and PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Metal Protective Trim Units:
   a. Rockwood Manufacturing (RO).
   b. Ives (IV).
   c. Trimco Manufacturing (TR).
2. Mop Plate
   a. Restrooms, Kitchen, Athletics
3. Kick Plate
   a. At high traffic areas
4. Armor Plate

a. Mechanical rooms, Athletics, Kitchen

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:
1. Brass/Bronze and Stainless Steel: .050 inches thick, beveled four sides (B4E) with countersunk screw holes.

D. Fasteners: Provide manufacturer's designated fastener type as indicated in door hardware sets.

2.18 Furnish protection plates sized 1 1/2 inches less than door width (LDW) on push side and 1 inch less door width on pull side by height specified in door hardware sets.

2.19 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.

2.20 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. 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.

C. Assa Abloy locks Integrated Wiegand access control products are required to be installed through current members of the ASSA ABLOY "Certified Integrator" (CI) program. Allegion products can be installed by Liscensed Integrator – no proprietary certification required.

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: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from 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.

B. Final Adjustment: Installer shall return and make final adjustment of all hardware once all air conditioning test and balance is complete. Final adjustment shall be made while air conditioner system is operating. Coordinate with General Contractor and Owner.

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

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.

Hardware Group No. 001 - OH DOOR/GRILL

For use on Door #(s):

Provide each RU door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE QTY/TYPE REQD	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES QTY/TYPE REQD	626	SCH
	EA	KEY SWITCH	(WHERE REQUIRED) PROVIDED BY SECTY CONTRACTOR QTY/TYPE REQD	630	SCE
	EA	NOTE	REMAINDER OF HARDWARE BY DOOR MFR.		

-COORDINATE HARDWARE WITH DOOR MFR.

Hardware Group No. 103 - SGL OFFICE LK (OFFICES/CONF/WKRM/LOUNGE)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 103A - SGL OFFICE LK (OFFICES/CONF/WKRM/LOUNGE)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRANCE LOCK	ND53TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	FLOOR STOP	1215CKU	626	TRI
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		

Hardware Group No. 201 - SGL STORAGE CLOSER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 203 - SGL STORAGE (SMALL)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 203-CUS - SGL CUSTODIAL

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	ARMOR PLATE	8400 32" X 2" LDW B-CS	630	IVE
1	EA	MOP PLATE	8400 6" X 1" LDW B-CS	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

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Hardware Group No. 203W - SGL STORAGE (SMALL)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 203W.K - SGL STORAGE (SMALL)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 205W - SGL EXTERIOR HM - MECH/STORAGE/RISER

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

Hardware Group No. 214 - PAIR STORAGE EXTERIOR

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	MANUAL FLUSH BOLT	FB458-LENGTH REQD	626	IVE
1	EA	DUST PROOF STRIKE	DP1	626	IVE
1	EA	STOREROOM LOCK	ND80TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	COORDINATOR	3780	BLK	ABH
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	OVERLAPPING ASTRAGAL	383AA-DOOR HEIGHT (OR AS REQD BY DR MFG)	AA	ZER
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

Hardware Group No. 341-FD - SGL PRIVATE TOILET (AT FOOD SERV)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PRIVACY W/COIN TURN	L9044 06A L583-363 L283-722	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
1	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 345 - SGL EXTERIOR PRIVATE TOILET (DLK/INDICATOR/CLSR)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	FAC RESTRM /HOTEL W/IND	L9486T 06A L583-363	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-V3-226-FRAME WIDTH	A	ZER
1	EA	COAT AND HAT HOOK	582M	626	IVE

-INDICATOR ON OUTSIDE OF DOOR.

Hardware Group No. 501 - SGL CLSSRM LK/CLOSER (ENTRY AREAS - TO ADMIN/NURSES/OFFICE)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 501A - SGL CLSSRM LK/CLOSER (ENTRY AREAS - TO ADMIN/NURSES/OFFICE)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT	689	LCN
1	EA	FLOOR STOP	1215CKU	626	TRI
1	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		

Hardware Group No. 501C - SGL CLSSRM LK/CLOSER (ENTRY AREAS - TO ADMIN/NURSES/OFFICE)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 503 - SGL CLASSROOM LOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 510 - PAIR CLASSROOM/CLOSERS (LAUNDRY)

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	AUTO FLUSH BOLT	FB31P/41P AS REQD	630	IVE
1	EA	DUST PROOF STRIKE	DP1/DP2 AS REQUIRED	626	IVE
1	EA	CLASSROOM LOCK	ND70TD RHO	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	COORDINATOR	3780	BLK	ABH
2	EA	SURFACE CLOSER	4050A-SHCUSH-TBSRT	689	LCN
2	EA	KICK PLATE	8400 10" X 1" LDW B-CS	630	IVE
2	EA	GASKETING	488S PSA H & J	BK	ZER
1	EA	OVERLAPPING ASTRAGAL	383AA-DOOR HEIGHT (OR AS REQD BY DR MFG)	AA	ZER

Hardware Group No. 701 - SGL EXIT DEVICE L-TRIM

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-99-L-06	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 710AMCV - PAIR VESTIBULE (ALUM SF)

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	CDSI-99-EO-SNB	626	VON
1	EA	PANIC HARDWARE	CDSI-99-NL-OP-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
3	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
4	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O

Hardware Group No. 711ELC - SGL EXIT DEVICE -ELEC RM

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC HARDWARE	LD-99-L-NL-06	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS WHERE APPLICABLE	630	IVE
1	EA	GASKETING	488S PSA H & J	BK	ZER

Hardware Group No. 714MA - PAIR EXTERIOR ENTRANCE (ALUM SF) EXIT DEVICES

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	PANIC HARDWARE	CDSI-99-EO-SNB	626	VON
1	EA	PANIC HARDWARE	CDSI-99-NL-OP-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
3	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
4	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O

Hardware Group No. 715 - SGL EXTERIOR HM EXIT DEVICE

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CDSI-99-NL-OP-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

Hardware Group No. 715W - SGL EXTERIOR HM EXIT DEVICE

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 5 X 4.5 NRP	630	IVE
1	EA	PANIC HARDWARE	CDSI-99-NL-OP-110MD-SNB	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER

Hardware Group No. 801LKR - PUSH/PULL/ DEADLOCK (ATHLETIC LOCKER ROOMS)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	MORTISE LOCK	LC-4878 (NO SUB)	626	SAR
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8305 8" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4050A-RW/PA-TBSRT	689	LCN
2	EA	ARMOR PLATE	8400 32" X 2" LDW B-CS BOTH SIDES	630	IVE
1	EA	FLOOR STOP	1215CKU	626	TRI
3	EA	SILENCER	SR64	GRY	IVE

Hardware Group No. 805L - SGL EXTERIOR PUSH/PULL/ DEADLOCK (GANG STUDENT RESTROOMS)

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	MORTISE LOCK	LC-4878 (NO SUB)	626	SAR
1	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	PUSH PLATE	8200 8" X 16"	630	IVE
1	EA	PULL PLATE	8305 8" 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS	630	IVE
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	JAMB SEAL	328AA-2PC-JAMB HEIGHT	AA	ZER
1	EA	HEADER SEAL	429AA-1PC-HEADER WIDTH	AA	ZER
1	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	655A-V3-226-FRAME WIDTH	A	ZER

Hardware Group No. C714MA - PAIR EXTERIOR ENTRANCE (ALUM SF) ACCESS CONTROLLED

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	POWER TRANSFER	EPT10	689	VON
1	EA	KEYED MULLION	KR4954-STAB-MT54	689	VON
1	EA	ELEC PANIC HARDWARE	CDSI-RX-99-EO-SNB	626	VON
1	EA	ELEC PANIC HARDWARE	RX-QEL-99-NL-OP-110MD-SNB 24 VDC	626	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
2	EA	FSIC MORT CYLINDER	20-059 ICX W/CONST. CORE	626	SCH
3	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 DT	630	IVE
1	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	SURFACE CLOSER	4050A-SCUSH-SNB	689	LCN
2	EA	PA MOUNTING PLATE	4050A-18PA TBSRT	689	LCN
2	EA	CUSH SHOE SUPPORT	4050A-30 TBSRT	689	LCN
1	EA	RAIN DRIP	142A DW + 4"	AA	ZER
1	EA	MULLION SEAL	8780NBK PSA	BK	ZER
	SET	SEAL	PERIMETER SEAL BY FRAME MFR.		
	SET	ASTRAGAL	MEETING STILE SEAL BY DOOR MFR.		
2	EA	DOOR SWEEP	39A-DOOR WIDTH	A	ZER
1	EA	THRESHOLD	65A-V3-226 FRAME WIDTH	A	ZER
	EA	BALANCE HARDWARE	BY DOOR MFG		B/O
	EA	CREDENTIAL READER	BY SECURITY CONTRACTOR		B/O
	EA	POWER SUPPLY	BY SECURITY CONTRACTOR		B/O

NOTES: OPERATION: DOORS NORMALLY CLOSED AND LOCKED. VALID CARD AT THE CARD READER RETRACTS THE LATCH ON THE ACTIVE LEAF FOR ENTRY. FREE EGRESS AT ALL TIMES. DOOR STATUS MONITORED.
CYLINDER DOGGING INDICATOR AT INACTIVE LEAF ONLY AT SECURITY DOORS.

Hardware Group No. J714M - PAIR GATE PANICS

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
2	SET	HINGE/CLOSER	MAMMOTH180-ZILV 180-GATE COMBINED (LOCINOX)		
2	EA	PANIC HARDWARE	PA-98-NL-OP-110MD-WH-SNB-SEC	630	VON
2	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
2	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
2	EA	DOOR PULL	VR910 NL	630	IVE
2	EA	FLOOR STOP	FS18L AS REQD	BLK	IVE
	EA		FIXED STEEL CENTER MULLION BY MTL FABRICATOR		
	EA		REMAINDER OF HARDWARE BY GATE FABRICATOR		
2	EA	GATE PANIC SHIELD (LOCKEYUSA OR SIM)	TYPE/SIZE/FINISH AS APPLICABLE (GC TO COORD W/RELATED TRADES)		

HARDWARE SET IS A GUIDELINE.
GC AND HARDWARE SUPPLIER TO REVIEW OPENING WITH OWNER/ARCHITECT AT LATER DATE TO DETERMINE EXACT REQUIREMENTS.
PROVIDE MOUNTING ACCESSORIES AS REQUIRED.
GENERAL CONTRACTOR SHALL CONDUCT A COORDINATION MEETING WITH THE HARDWARE SUPPLIER AND GATE/FENCE FABRICATOR PRIOR TO HARDWARE BEING ORDERED - AND FENCE/GATE BEING FABRICATED.

Hardware Group No. J715 - SGL EXTER GATE PANIC

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	SET	HINGE/CLOSER	MAMMOTH180-ZILV 180-GATE COMBINED (LOCINOX)		
1	EA	PANIC HARDWARE	PA-98-NL-OP-110MD-WH-SNB-SEC	630	VON
1	EA	FSIC RIM CYLINDER	20-057 ICX W/CONST. CORE	626	SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
1	EA	DOOR PULL	VR910 NL	630	IVE
1	EA	FLOOR STOP	FS18L	BLK	IVE
1	EA	GATE PANIC SHIELD (LOCKEYUSA OR SIM)	TYPE/SIZE/FINISH AS APPLICABLE (GC TO COORD W/RELATED TRADES)		
	EA		REMAINDER OF HARDWARE BY GATE FABRICATOR		

HARDWARE SET IS A GUIDELINE.
GC AND HARDWARE SUPPLIER TO REVIEW OPENING WITH OWNER/ARCHITECT AT LATER DATE TO DETERMINE EXACT REQUIREMENTS.
PROVIDE MOUNTING ACCESSORIES AS REQUIRED.
GENERAL CONTRACTOR SHALL CONDUCT A COORDINATION MEETING WITH THE HARDWARE SUPPLIER AND GATE/FENCE FABRICATOR PRIOR TO HARDWARE BEING ORDERED - AND FENCE/GATE BEING FABRICATED.

Hardware Group No. J-1PL - SGL GATE PADLOCK

For use on Door #(s):

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PADLOCK (LFIC/SFIC AS REQD)	KS41D1200 / KS43D3200 X 1-1/2" SHACKLE		SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
	EA		REMAINDER OF HARDWARE BY GATE FABRICATOR		

PROVIDE MOUNTING ACCESSORIES AS REQUIRED.
GENERAL CONTRACTOR SHALL CONDUCT A COORDINATION MEETING WITH THE HARDWARE SUPPLIER AND GATE/FENCE FABRICATOR PRIOR TO HARDWARE BEING ORDERED - AND FENCE/GATE BEING FABRICATED.

Hardware Group No. J-2PL - PAIR GATE PADLOCK

For use on Door #(s):

Provide each PR door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	PADLOCK (LFIC/SFIC AS REQD)	KS41D1200 / KS43D3200 X 1-1/2" SHACKLE		SCH
1	EA	FSIC PERM CORE	23-030 EVEREST T-29 SERIES	626	SCH
	EA		REMAINDER OF HARDWARE BY GATE FABRICATOR		

PROVIDE MOUNTING ACCESSORIES AS REQUIRED.
GENERAL CONTRACTOR SHALL CONDUCT A COORDINATION MEETING WITH THE HARDWARE SUPPLIER AND GATE/FENCE FABRICATOR PRIOR TO HARDWARE BEING ORDERED - AND FENCE/GATE BEING FABRICATED.

END OF SECTION

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SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glass and glazing accessories.

B. Related Sections:
   1. Section 07 92 00 - Joint Sealants
   2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.

1.2 PERFORMANCE REQUIREMENTS

A. Glass and glazing materials of this section shall provide continuity of building enclosure vapor and air barrier
   1. In conjunction with materials described in SECTION 07 92 00 - JOINT SEALANTS.
   2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.

B. Design and size glass to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ASTM E 330.

C. Limit glass deflection to l/200 or flexure limit of glass with full recovery of glazing materials, whichever is less.

D. Windborne-debris-impact Resistance: Provide exterior glazing that passes basic-protection testing requirements in ASTM E 1996 for Wind Zone 1 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than glazing indicated for use on the Project and shall be installed in same manner as glazing indicated for use on the Project.
   1. Large-Missile Test: For glazing located within 30 feet of grade.
   2. Small-Missile Test: For glazing located more than 30 feet above grade.

1.3 SUBMITTALS

A. Submit product data and samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

C. Provide data on glazing sealant. Identify colors available.

D. Samples:
   1. Submit 2 samples of each type of glass (except clear glass), 12" x 12" in size, illustrating glass unit, coloration, design.
   2. Submit 4" long bead of glazing sealant in color selected.

1.4 QUALITY ASSURANCE

A. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual."

B. Source Quality Control: Glass shall be identified by the manufacturer's labels of grade and quality. Temporary labels shall not be removed until final cleaning. Permanent labels on tempered glass shall not be removed.
   1. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glass and glazing materials during delivery, storage, and handling as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, or temperature changes, and other causes.

1.6 WARRANTY

A. Provide written 10-year warranty signed by manufacturer of insulating glass agreeing to furnish replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure of hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, and other visual indications of seal failure or performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design products are Vitro Architectural Glass (PPG): Provide glass as manufactured by one of the following:
   AGC Glass North America
   Guardian Industries Corp.
   Technical Glass Products
   Oldcastle Building Envelope
   Pilkington North America, Inc. (NSG Group)
   Vitro Architectural Glass (formerly PPG Glass)

2.2 GLASS

A. (TT1) Tinted, Tempered, Insulating Low-E Glass: Manufacturer's standard 1" thick pre-assembled units consisting of 2 sheets of tempered glass, ASTM C 1048, enclosing a hermetically sealed dehydrated air space; with spacers, sealant, and without protective edge banding. Metal spacers shall be finished to match finish of aluminum storefronts.
   1. Thickness of Each Pane: 1/4".
   2. Air Space Thickness: 1/2".
   3. Interior Pane: Type I, Class 1 (Clear), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition A - Uncoated surfaces.
   4. Exterior Pane: Type I, Class 2 - Vitro Solargray tint (Tinted Heat-Absorbing and Light-Reducing), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition C - Other coated surfaces with low-emissivity Vitro Solarban 60 coating on second surface
   5. Performance Characteristics: Low-E insulating glass shall comply with the following:
      Solar Heat Gain Coefficient: 0.25
      Winter U-value: 0.29.
      Visible Transmittance: 35%

B. (TFE1) Tinted, Forced-Entry Resistant, Insulating Low-E (Security):
   1. Basis of Design: Subject to compliance with requirements, provide the following safety and security films:
      C-Bond Systems, LLC; Safety and Security Films
      6035 South Loop East
      Houston, TX 77033
      Phone: 832-649-5658
      Fax: 713-513-5880
      www.cbondsystems.com
      info@cbondsystems.com
   2. Interior Pane: Subject to compliance with requirements, provide the following safety and security glass:
      ArmorProtect Plus 121000 (7/16”) by Oldcastle
      SG5 (7/16”) by School Guard Glass
      Childgard/Accessgard-2118 (7/16”) by Global Security Glazing
   3. Air Space Thickness: 1/2".
   4. Exterior Pane: 1/4” thick, Type I, Class 2 **-** Vitro Solargray tint (Tinted Heat-Absorbing and Light-Reducing), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition C - Other coated surfaces with low-emissivity Vitro Solarban 60 coating on second surface
   5. Performance Characteristics: Low-E insulating glass shall comply with the following:
      Solar Heat Gain Coefficient: 0.23
      Winter U-value: 0.29.

Visible Transmittance: 34%

C. (CT4) Clear, Tempered Glass: ASTM C 1048, Type I, Class 1 (Clear), Quality q3 (Glazing select). Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thickness.

D. (CFE4) Clear, Forced-Entry Resistant (Safety): One layer of 15 mils (0.015 inch) thick film, applied to interior glass surfaces where indicated, utilizing C-Bond technology, a patented, non-toxic, water-based, nano-technology fluid.
   1. Glass: Minimum 1/4" thickness (6mm), ASTM C 1048, Type I, Class 1 (Clear), Quality q3 (Glazing select). Kind FT - Fully Tempered, Condition A - Uncoated surfaces.
   2. Film: 15 mils (0.015 inch), meeting UL 972-Standard for Safety Burglary Resisting Glazing Material.
   3. Color: Clear
   4. New Framing and Glazing: Provide forced-entry glass for new aluminum framed doors and windows as indicated. Include glazing anchor system as specified for safety.

E. Tempered, One-Way Glass: Provide 1/4" thick grey tint Mirrorpane T.M. Transparent Mirror glazing as manufactured by Pilkington, North America Inc. (phone 419.247.3731 web site: www.pilkington.com), providing a visible transmittance of 12% and a visible reflectance of 60%.

F. Clear Glass Mirrors, Unframed: ASTM C 1503, Mirror Select.
   1. Nominal thickness 1/4". Backs shall have two coats of silver hermetically sealed, complying with GS-27, with an impervious protective coating of copper deposited over silver by electrolysis, and finished with a special composition hard, mirror-backing paint. Mirrors shall bear manufacturer's labels. Mirrors shall have ground and polished edges.
   2. Mirror Back Safety Tape: ANSI Z97.1.
   3. J-Molds: Provide stainless steel continuous "J" clip at bottom and "J" clips around perimeter of mirror to anchor mirror to wall (Approx. Size: 3/8" x 3/8").

2.3 GLAZING MATERIALS

A. Glazing Compound: Comply with ASTM C 1311 or FS TT-S-00230, one-part, non-sag acrylic polymeric sealant. Product/manufacturer; one of the following:
   Acryl-R Acrylic Sealant; Schnee-Moorehead, Inc.
   Mono 555; Tremco

B. Channel Glazing Strips; Hollow Metal Doors and Frames: Provide black vinyl channel glazing strips, Glazing Vinyl for 990 Sliders Part #6062-01 as manufactured by Kawneer.

C. Accessories: Setting blocks, tape, vinyl gaskets and spacer strips as required for a complete installation.

D. Mirror Mastic: Combination of asphaltic bitumens, fibers and mineral spirits. Product/manufacturer; one of the following:
   Gunther Pro®; Gunther Mirror Mastics
   7HR4 Mirror Tac®; Pecora Corp.
   Mirro-Mastic; Palmer Products Corporation.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive glass for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Setting Glass: Glazing shall be done at the site by skilled glaziers in conformance with the general conditions governing glazing in the GANA Glazing Manual.
   1. Glazing of aluminum windows and storefront shall be done in conformance with the methods recommended by the manufacturer of the aluminum items. Beads or stops furnished with the items to be glazed shall be used to secure the glass in place.
   2. Verify glass sizes for required edge clearances by measuring the openings. Cut each piece accurately and fit to its particular position. Center glass in the opening vertically and horizontally. Use edge blocks in vertical jambs to prevent lateral "walking" of the glass.
   3. Glass shall have clean cut edges. Do not seam, nip, stone or strike edges, or scarf corners, and do not install glass with flared edges at the bottom. Do not bump, drag, or rest the edge of a glass light against metal or other hard objects.
   4. Set tempered glass with tong marks completely concealed or in as inconspicuous a location as possible.

3.3 CLEANING

A. Upon completion of the building, clean glass on both sides and remove labels, paint spots, putty and other defacement. Replace damaged glass with new.

END OF SECTION

SECTION 09 21 16

GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Metal stud wall framing.
2. Furred wall framing.
3. Metal channel ceiling framing.
4. Gypsum board partitions, ceilings, and furrings.
5. Finishing of panel joints.

B. Related Sections:
1. Section 06 16 56 - Air- and Water-Resistive Sheathing Board System
2. Section 05 40 00 - Cold-Formed Metal Framing: exterior wall studs.
3. Section 07 21 00 - Building Insulation: acoustical and thermal insulation.
4. Section 07 84 00 - Firestopping.
5. Section 09 30 13 - Ceramic Tiling: backer board at shower areas.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES. Submit materials list of items proposed to be provided, manufacturer's data indicating compliance with specified requirements, and manufacturer's recommended installation procedures.

B. Submit diagrams of proposed control joint and expansion joint layout prior to starting work.

1.3 QUALITY ASSURANCE

A. Tolerances for Drywall: Do not exceed a variation of 1/8" in 10'-0" and 1/16" in 5'-0" from plumb, level, and flat (all directions) and do not exceed 1/16" offset of planes at joints between panels. Shim panels as necessary to comply with tolerances.

B. Perform Work in accordance with ASTM C 840, GA-216, GA-223 and GA-600.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: In cold weather, maintain the temperature of the building reasonably constant at no less than 55° F. during gypsum panel application and joint finishing. Provide adequate ventilation to carry off excess moisture.

1.5 DELIVERY, STORAGE, HANDLING

A. Deliver, store, handle, and protect products in conformance with manufacturer's instructions and in accordance with Section 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and Section 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store inside building, on sleepers, and out of water.

1.6 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum three years documented experience.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Gypsum Board (20A): ASTM C 1396. Provide Type X fire-rated; 48"w x 5/8" thick by maximum permissible length gypsum board with tapered edges. Product/manufacturer; one of the following:
   CertainTeed Type X; CertainTeed Gypsum
   ToughRock Fireguard X Gypsum Board: G-P Gypsum Corp.
   Fire-Shield Gypsum Wallboard; National Gypsum Co.
   Sheetrock Brand Firecode X Gypsum Panel; USG Corporation

B. Abuse-Resistant Gypsum Board (20B): ASTM C 1396, manufactured to produce greater resistance to surface indentation and through-penetration than standard gypsum panels. Provide Type X fire-rated, 48"w x 5/8" thick by maximum permissible length gypsum board with tapered edges. Product/manufacturer; one of the following:
   AirRenew Extreme Abuse Resistant Gypsum Board; CertainTeed Gypsum
   ToughRock Abuse-Resistant Gypsum Board; G-P Gypsum Corp.
   Gold bond Hi-Abuse Wallboard; National Gypsum Co.
   Sheetrock Brand Abuse-Resistant Gypsum Panels; USG Corporation

C. Gypsum Tile Backer Board: Refer to Section 09 30 00 - TILING for gypsum tile backer board to be used:
   1. As a substrate for ceramic tile walls at all shower areas
   2. At accessible shower ceilings, unless cement plaster is indicated.

D. Sheathing Board System: Reference SECTION 06 16 56 - AIR- AND WATER-RESISTIVE SHEATHING BOARD SYSTEM.

E. Studs: ASTM C 645. Non-loadbearing channel type roll-formed from minimum 25 gauge electro- or hot-dipped galvanized steel.
   1. Provide 20 gauge studs at interior ceramic tile partitions.
   2. Provide 18 gauge studs, per SECTION 05 40 00 - COLD-FORMED METAL FRAMING, at all X-bracing.

F. Slotted Top Track: Sliptrack Systems, SLP-TRK®, (phone 888.475.7875 web site: www.sliptrack.com).
   1. 25 ga thick, to ASTM A653/A653M, Grade 33 with a minimum yield point of 33,000 psi, electro- or hot-dipped galvanized steel.
   2. 2-1/2" down-standing legs with 1/4" wide by 1-1/2" high slots spaced at 1" on center.
   3. Track width shall match stud size by manufacturer's standard length.
   4. Fasteners: ASTM C 1002, self-drilling, self-tapping screws.

G. Furring, Framing and Accessories: Provide in conformance with ASTM C 645, GA-216, and GA-600 and as follows:
   1. Cold Rolled Channels: 3/4", 1-1/2" and 2" x 9/16", 16 gauge, steel channels prime painted.
   2. Furring Channels: ASTM 645, 7/8" deep x 1-1/4" face, roll-formed from 25 gauge electro-galvanized steel and furnished with galvanized wire clips.
   3. Resilient Furring: 1/2" deep x 2" x 1-1/4" screw flange, 25 gage, galvanized with one leg attached only, Style RC-1 PRO™ as manufactured by ClarkDietrich Building Systems.

H. Fasteners: ASTM C 514 for nails and C 1002 for screws as follows:
   1. Inserts, clips, bolts, nails or other screws as recommended by wallboard manufacturer, of type and size to suit application and to rigidly secure materials in place.
   2. Self-drilling, self-tapping bugle head screws for use with power drive tool.
   3. Screws: Drywall Screws, Type S Bugle Head.
   4. Metal framing to structure: Power driven screw fasteners to withstand 190 lb. single shear resistance and 200 lb. bearing force when drive through structural head or base and without exceeding allowable design stress in runner, fastener, or structural support.
   5. Metal to metal: 3/8", Type S or S-12, pan head screws.
   6. Gypsum board to sheet metal application: Type S Bugle Head screws.
   7. Gypsum board to gypsum board application: Type G screws.

I. Adhesive: Utilize adhesive meeting requirements of GA-216 over metal framing.

J. Accessories:
1. Runners: ASTM C 645, channel type sections roll-formed from electro-galvanized steel with unhemmed edges. Same gauge as studs with which used.
2. Hangers: No. 8 gauge annealed, galvanized wire.
3. Tie Wire: No. 16 gauge annealed, galvanized wire.
4. Trim: Galvanized steel corner reinforcements, edge trim angles and casings; USG No. 200 series.
5. Reinforcing Tape: 2-3/16" minimum width, cross laminated, spark perforated fiber tape.
6. Joint Compound: Quick-drying, polyindurate-type, pre-fill material.
7. Joint Topping: Vinyl base all-purpose finishing material.
8. Acoustical Sealant: A one-part acrylic base sealant designed for use with drywall construction.
9. Edge Sealant: USG Sheetrock Brand W/R Sealant for use in high-moisture room areas.
10. Control Joints: Roll-formed zinc control joints with 1/4" slot (USG #093).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Workmanship: The completed gypsum wallboard surfaces shall be smooth, level or plumb, and acceptable to the finish material applicators. All joint treatment on exposed wallboard shall be invisible after painting.

B. Ceiling Furring:
1. Install in accordance with ASTM C 754, GA-216, GA-223 and GA-600 and manufacturer's instructions.
2. Space ceiling hangers 48" o.c. along runner channels and within 6" of ends of channel runs. Wrap or saddle-tie hangers around the runner channels to prevent twisting.
   a. Under steel construction, wrap hangers around or clip or bolt hangers to a structural steel member (not steel deck).
   b. Under bar joists suspend hangers from top chord or from bottom chord at panel points only.
   c. Under ductwork, employ trapeze system of hangers to support ceiling. Do not suspend hangers from ducts, piping or conduit.
3. Erect runner channels at 48" o.c. maximum and locate a channel within 4" of each parallel wall. Level channels with hangers taut and do not make kinks or bends in the hangers as a means of leveling. At channel splices, overlap ends 12" with flanges interlocked; secure each end with tie wire.
4. Erect furring channels at 16" o.c. for 1/2" thick gypsum or 24" o.c. for 5/8" thick gypsum board and at right angles to runner channels or main support members; secure with clips or saddle-tie to supports with tie wire. Make end splices by nesting channels 8" and wire tying each end.
5. At light troffers or other openings that interrupt the runner or furring channels, install additional reinforcing to restore lateral stability of the grillage.
6. No part of the suspended grillage (main runners and cross furring) shall be permitted to come in contact with abutting masonry walls and partitions.

C. Wall Furring: For gypsum wallboard over masonry, space furring channels vertically at 24" o.c. maximum and attach with power driven anchors through alternate wing flanges (staggered), spaced 24" o.c. Make end splices with 8" nested laps anchored to wall with two fasteners in each wing. Where necessary, install furring with adjustable furring brackets and 1/2" x 3/4" steel channels to which the furring channels shall be clipped or tied.

D. Partitions:
1. Follow recommendations of U.S. Gypsum Co., "Gypsum Construction Handbook".
2. Install studding in accordance with ASTM C 754, GA-216, GA-223 and GA-600.
3. Erect partitions with studs aligned to be plumb and true. Anchor studs top and bottom with runners, shoes and clips.
4. Attach floor runners to concrete slabs using shielded screws or power driven fasteners. Locate fasteners at corners and at runner ends and spaced not to exceed 24" o.c.
5. Under drywall ceilings, attach metal runner to ceiling and position studs to engage the ceiling runner. Elsewhere, extend studs above the ceiling and brace securely to the floor above or roof structure above with a continuous top runner and channel braces unless specifically detailed otherwise. Where studs extend more than 24" above finished ceiling line, provide either 5/8" gypsum board on both sides of studs or horizontal bracing at 16" o.c. attached with mechanical fasteners to both flanges of studs.
6. For fire rated partitions and where specifically detailed or noted, extend studs full height to the floor or roof structure above.
7. Space studs as shown and noted but not more than 16" o.c. Locate studs not more than 2" from abutting partitions and partition corners. Anchor studs to runner flanges with positive screw engagement where located at corners and at door frame jambs.

8. At door frame jambs of doorways up to 4'-0" wide, double the studs or reinforce with 20 gauge steel studs. At jambs of doorways over 4'-0" wide, reinforce with two 20 gauge steel studs placed back to back. Fasten reinforcing studs to the anchor clips on each door frame with bolts or screws. Place horizontally over each frame a cut-to-length section of runner track; attach with screws to the adjacent vertical studs.
9. In chase wall construction, set studs opposite each other with the flanges in the same direction and cross brace between the rows of studs with three 12" high pieces of gypsum board or three pieces of metal stud attached to each pair of studs at the quarter points with drive screws.
10. Double the studs at vertical control joints in partitions.
11. Brace partitions to top chord of the structure above with 20 ga. diagonal braces at 4'-0" o.c. minimum. Where floor to structure height exceeds 16'-0", in addition to extending and fastening studs to structure, add 20 ga. stud diagonal braces at 4'-0" o.c. minimum.

E. Slotted Top Track: Install slotted track in strict accordance with manufacturer's written instructions and recommendations.
1. Secure studs to slotted top track with #8 wafer-head screws.
2. Maintain minimum deflection gap of 0.65 inch between top of stud and top of slotted track.
3. Limit vertical movement to 1 inch, plus or minus 1/2 inch.

F. Sealant Application: Caulk those gypsum drywall partitions which have sound attenuation blankets, serving as sound barriers.
1. Apply sealant in two continuous beads underneath runners at the floor and ceiling and where runners are used at partition intersections with dissimilar wall construction.
2. Fill with sealant the grooves around the edges of wallboard at the floor, ceiling, and intersections with dissimilar walls.
3. Caulk fully the openings around all cut-outs at electrical boxes, heating ducts and the like.

G. Wallboard Application:
1. Apply gypsum wallboard first to the ceilings and then to the partitions. Use maximum practical lengths to minimize end joints. Fit ends and edges closely but not forced together.
2. For single-layer ceiling application, apply wallboard with the long dimension either parallel or at right angles to the framing members. All abutting ends and edges shall occur over framing members, except in horizontal application. Stagger end joints in adjacent rows.
3. For single-layer wall application with a ceiling height of 8'-2" or less, use either the horizontal or the vertical application method. With a ceiling height over 8'-2" and for fire-rated partitions, use only the vertical application method without any exposed horizontal joints. Stagger the vertical joints on opposite sides of a partition. Extend wallboard full height to the floor or roof structure above where so detailed.
4. Fasten wallboard firmly to studs and furring channels with power-driven drywall screws. Gypsum board shall extend to within 1/4" of floor line. Drive screw heads close without cutting the surface paper or fracturing the core. Maximum screw spacing shall be 12" o.c. for ceilings and 16" o.c. for partitions. For fire-rated partitions, maximum spacing shall be 12" o.c. Do not drive screws closer than 3/8" from any edge.
5. For two-layer wall application, apply the base layer of wallboard vertically; attach with screws spaced 16" o.c. Apply the face layer vertically with joints offset 24" from base layer joints; attach with adhesive and 1-5/8" screws spaced 16" o.c.
6. Wallboard joints in single layer or in face layer of two layer applications shall not occur within 12" of the corners of door frame, window frames, and openings larger than 12" x 12", unless control joints are installed at the corners.
7. Accurately cut and fit abutting ends, edges and holes for pipes and electrical fixtures. Support the edges of gypsum wallboard at cutouts and openings.
8. Reinforce exposed external corners with metal corner reinforcement.
9. Where wallboard surfaces abut dissimilar intersecting surfaces such as metal and masonry, trim the meeting edge with a metal trim angle held approximately 1/4" away from the intersecting surface. Caulk the joint full with sealant; tool smooth.
10. After application, check all gypsum wallboard for loose fasteners; drive tight any found loose.

H. Control Joints:
1. Isolate gypsum wallboard surfaces with control joints where specifically detailed and where the following conditions exist:
   a. Partition or furring run exceeds 30 feet without a corner or a ceiling-height door frame.
   b. Ceiling dimensions exceed 50 feet in either direction.
   c. Construction changes within the plane of the partition.
   d. Each side of column furring within a partition run.
   e. Above each door jamb from head to top of partition.

f. At each side of furr downs.

2. Locate control joints in partitions at less-than-ceiling-height door frames with control joints extending to the ceiling from both top corners.
3. Make joints with roll-formed zinc control joints (USG #093) with 1/4" slot.
   a. Do not install roll-formed joint behind ceramic tile. Provide a 1/4" wide gap in the substrate only.
   b. At acoustical partitions, seal behind the joints with acoustical sealant.
4. Back-block ceiling control joints with face panel strips laid over the joints.
5. At acoustical partitions, seal behind partition control joints with batt acoustical insulation stuffed between the doubled studs.

I. Edge Sealing: On wallboard partitions to be covered with ceramic tile, treat cut edges, holes, corner joints, and intermediate joints with edge sealant before installation of wallboard panels. Treat all fastener heads with edge sealant after installation. Caulking of openings through ceramic tile is specified in SECTION 09 30 13 - CERAMIC TILING.

J. Joint Treatment:
1. Finish the joints in exposed wallboard, wallboard which is to be covered with vinyl wall covering and carpet wall covering, and wallboard in sound partitions to deck. Joints in wall board to be covered with ceramic tile shall be filled but may be left unfinished.
2. Fill the V-grooves between boards with quick drying joint compound. Wipe joints clean of excess compound and allow to harden.
3. Apply a thin layer of joint topping to joints. Immediately embed tape reinforcement over joints, follow with a skim coat of compound.
4. Apply joint topping over the tape to fill flush with the board surface.
5. Apply joint topping over the fill coat and feather out smoothly beyond fill coat edge. Sand between coats as necessary to provide a smooth surface ready for painting.
6. Fill screw head depressions flush with three coats of compound.
7. Finish metal corner reinforcements and edge and control joint trim with two or three coats of joint compound, using edge of trim as a screed to secure a smooth, flat finish.

K. Special Finishes for Gypsum Board Surfaces:
1. Areas Designated with Dry Erase Coating (paint-type) and Custom Digital Vinyl Wallcovering (Graphics): Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 5 Finish per ASTM C840 and GA-214-Recommended Levels of Gypsum Board Finish. Recess nails and screws. Repair irregular tape joints, sand and remove dust. Ensure gypsum wallboard surfaces scheduled to receive dry-erase coatings are properly primed with recommended primer.
2. Areas Designated with Dry Erase Wall Covering and Wall Protection Panels: Examine substrates and installation conditions to ensure surface conditions meet or exceed a Level 4 finish, per ASTM C840 and GA-214-Recommended Levels of Gypsum Board Finish.
3. Permanent lighting should be installed and operational for inspection of these areas prior to application of wall finish.

3.2 TOLERANCES

A. Maximum variation from true flatness: 1/8" in 10 feet in any direction.

END OF SECTION

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SECTION 09 30 00

TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Ceramic Tile.
2. Porcelain Tile.
3. Tile Trim and Accessories.
4. Marble and Engineered Thresholds.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry; wood blocking at windowsills.
2. Section 07 92 00 - Joint Sealants.
3. Section 09 21 16 - Gypsum Board Assemblies.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. Submit manufacturer’s written product data for each tile type and accessory.

C. Samples: Submit tile samples of the same size scheduled for each particular type of tile required.

D. Certificate: Furnish one master grade certificate on ceramic tile executed prior to delivery of the tile to the site.

1.3 QUALITY ASSURANCE

A. Standard: Tile shall be Standard Grade complying with the requirements of ANSI A 137.1. Deliver tile to the project site in grade sealed containers.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained.

B. Do not install adhesives in a closed, unventilated environment.

C. Maintain 50°F. during installation of mortar materials.

1.5 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to the project site one box for each type, color, pattern, and size of tile installed. Furnish maintenance materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identifying labels.

PART 2 - PRODUCTS

2.1 TILE

A. Manufacturers: Ceramic tile and trim as manufactured by American Olean, Dal-Tile Corp., Interceramic, and Crossville Ceramics shall set all standards in the areas of trim shapes availability, tile size, color, pattern, and texture.

B. Ceramic and Porcelain Tile: Reference MATERIAL FINISH SCHEDULE in drawings for manufacturer, product, color and finish of tile.

C. Trim Pieces:
   1. Provide factory made fitters and trim shapes required for a finished installation. Keep job-cut fitters and trim shapes to a minimum. Provide bullnose tile at horizontal and vertical tile edges.

D. Floor Tile Wet Dynamic Coefficient of Friction: Not less than 0.42, when tested in conformance with ANSI A137.1.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, domestic manufacture.

B. Dry-Set Mortar: ANSI A 118.1, factory sanded mortar mix.

C. Latex-Portland Cement: ANSI A 118.15, flexible mortar consisting of cement-based mix and latex additive.

D. Adhesive: ANSI A 136.1, Type I, prepared organic adhesive.

E. Grout:
   1. Floor:
      a. ANSI A118.7, latex modified dry-set High Performance Cement Grout or commercial waterproof cement grout. Provide Ultracolor Plus FA as manufactured by MAPEI or approved equivalent by Custom Building Products or Laticrete. Color(s) shall be selected by Architect.
      b. ANSI A118.3; epoxy grout at restrooms, and associated areas. Provide Kerapoxy CQ as manufactured by MAPEI or approved equivalent by Custom Building Products or Laticrete. Color(s) as selected by Architect.
   2. Walls: Modified acrylic, premixed Mastic Grout or dry-set grout complying with ANSI A118.7, color(s) as selected by Architect from Custom Building Products, Laticrete, Mapei or approved equal. If Contractor elects to provide dry-set grout, the installation shall be damp cured.

F. Lime: ASTM C 207, Type S, hydrated lime.

G. Sand: ASTM C 144, clean, masonry sand.

H. Water: Clean and potable.

I. Reinforcement: 1-1/2" x 17 gage galvanized woven steel wire fabric or 2 x 2 x 16/16 gage galvanized welded steel wire fabric.

2.3 SETTING BED MORTAR

A. Mix one part Portland cement and 4 parts damp sand, by volume. Hydrated lime may be added for plasticity in an amount not to exceed 1/10 part by volume.

B. Large Format and Heavy Tile Mortar: Provide Ultraflex LFT (medium bed mortar) as manufactured by MAPEI or approved equivalent.
   1. High content of dry polymer
   2. Nonsag and nonslump formula.
   3. Meets the highest ANSI rating of ANSI A118.15.

2.4 ADHESIVE/WATERPROOF MEMBRANE

A. Urethane Waterproofing and Tile-setting Adhesive: One-part liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two-step process. Product/manufacturer; one of the following:
   Hydroment Ultra-Set; Bostik
   Deck-Seal 1000; Southern Grouts & Mortars, Inc.

B. Reinforcing: Woven glass fiber scrim, 2" wide roll.

C. Large Format and Heavy Tile Waterproofing/Crack Isolation Membrane: Provide Mapelastic Aquadefense as manufactured by MAPEI or approved equivalent. Include Reinforcing fabric at change of planes and at drain areas.

2.5 SHOWER PAN

A. Shower Pan: Provide one of the following or approved equal 40-mil thick waterproofing sheet membranes at thickset tile applications:
   Composeal Blue Shower Pan Membrane; Compotite Corp.
   Chloraloy Shower Pan Liner; Noble Co. (Div. of Federal Process Corp.)

2.6 BACKER BOARD

A. Tile Backer Board: ASTM C 1178:
   1. Installation under ceramic tile on steel studs at shower locations.
   2. At accessible shower ceilings, unless cement plaster is indicated.
   3. Provide one of the following Products/Manufacturers:
      5/8" Diamondback GlasRoc Type X Tile Backer; CertainTeed Gypsum
      5/8" DensShield Fireguard Type X Tile Backer; Georgia-Pacific Corp
      5/8” Gold Bond Brand eXP Type X Tile Backer; National Gypsum Company
      5/8” Durock Brand Glass-Mat Type X Tile Backer; USG Corporation

2.7 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated.
   1. Contractor’s Option: Provide either tile manufacturer’s standard product as stated above, or the following product:
      a. Chlorinated Polyethylene Sheet: Non-plasticized elastomer with non-woven polyester laminated to both sides, nominal 0.030" thickness. Product/manufacturer; NobleSeal CIS; Noble Co.

2.8 ACCESSORIES

A. Metal Floor Transition Trim: Provide Schiene protective edge trim by Schluter Systems L.P. Finish shall be satin anodized aluminum. Height as required to flush out with top of tile flooring.

B. Metal Floor Transition Trim: Provide Reno-U protective edge trim by Schluter Systems L.P. Finish shall be satin anodized aluminum. Height as required to flush out with top of tile flooring.

PART 3 - EXECUTION

3.1 PREPARATION

A. Sweep concrete slab surfaces clean and free of dirt and debris. Remove oil, grease, paint, and dried mortar.

B. Shower Pan Membrane Installation:
   1. Coat surface to receive membrane waterproofing with a minimum 3/16" thick coat of bond coat adhesive and in accordance with manufacturer’s recommendation and ANSI A 108.5.
   2. Provide PVC solvent cement welding of all seams and penetrations including drains.
   3. Provide factory fabricated pre-molded inside and outside corners.

C. Shower Wall Tile Base: At showers, install tile backer board. Apply with un-cut long edge at bottom of work. Fasten boards to steel stud framing with Type S bugle head drywall screws spaced 6" o.c. Space fasteners at least 3/8" from edge of board.

D. Concrete Slab-on-grade: Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions and recommendations to produce membrane bonded securely to substrate.

3.2 INSTALLATION

A. General Workmanship:
   1. Center and balance areas of tile, if possible.
   2. Do not make an excessive amount of cuts. Usually, no cuts smaller than half size should be made. Make all cuts on the outer edges of the field. Fit tile carefully without marring or chipping the finish.
   3. Smooth cut edges. Install tile without jagged or flaked edges.
   4. Fit tile closely where edges will be covered by trim, escutcheons or other similar devices.
   5. The splitting of tile is expressly prohibited except where no alternative is possible.

6. Maintain the heights of tilework in full courses to the nearest obtainable dimension where heights, given in feet and inches, are not required to fill vertical spaces exactly.
7. Make corners of all tile flush and level with corners of adjacent tile, with due allowance to tolerances for tile as specified in ANSI A137.1.
8. Keep all joint lines straight and even width, including miters.
9. Thoroughly back-up with thin-set bonding material all thin-set units, molded or shaped pieces; secure firmly in place.
10. Thoroughly back-up with mortar-bed mix thick-bed nosings, coves, curbing, gutters, flat tile and trimmers, molded or shaped pieces; secure firmly in place.
11. Bond coat mix shall not be used to back-up thick-bed trim and angles. Coat all thick-bed trim shapes with 1/32" to 1/16" of bond coat mix.
12. Finish floor and wall areas level and plumb with no variations exceeding 1/8" in 8' from the required plane.
13. Install accessories in tile work to be evenly spaced, properly centered with tile joints, and level, plumb and true to the correct projection. Install accessories at locations and heights designated.
14. Finished tile work shall be clean. Replace pitted, chipped, cracked and scratched tiles.

B. Setting Floor Tile - Conventional:
1. Set floor tile in straight joint pattern using Portland cement mortar in conformance with ANSI A 108.1.
2. Where tile is to be installed over waterproofing membrane, place wire reinforcing and mortar bed over the membrane. Lap reinforcing one full mesh and support so that it is completely embedded in the mortar bed.
3. Spread on a bonding coat of pure Portland cement paste not more than 15 minutes ahead of the mortar bed for quarry tile.
4. Place mortar bed, tamp firmly and screed to true planes and proper slopes. While still plastic, trowel a bond coat of cement paste over the mortar bed or dust a thin layer of dry cement over the mortar bed and work lightly until damp.
5. Set tile firmly on the mortar bed with close, uniform joints. Press and thoroughly beat in tile while the mortar bed is still plastic. Bring surfaces to true planes at the proper position of elevation. Slope tile down to floor drains. Make any adjustment of tile before initial set of the mortar takes place.

C. Setting Floor Tile - Thinset:
1. Set floor tile in straight joint pattern using dry-set cement mortar in conformance with ANSI A 108.5.
2. Mix and apply dry-set mortar in conformance with the manufacturer's recommendations. Cover surface evenly and comb with a notched trowel not more than 10 minutes before applying tile.
3. Set tile before initial set of the mortar has taken place. Press and beat tile firmly into place to establish proper and complete bond. Joints shall be close and uniform.

D. Setting Wall Tile:
1. Set base and wall tile over masonry in straight joint pattern using dry-set cement mortar in conformance with ANSI A 108.5.
2. Set base and wall tile of size less than 12" x 12" over gypsum wallboard in straight joint pattern using organic adhesive in conformance with TCA W242 and ANSI A 108.4.
3. Set base and wall tile of size more than 12" x 12" over gypsum wallboard in straight joint pattern using Latex Portland cement mortar in conformance with TCA W243 and ANSI A 108.5.
4. Surfaces to be tiled shall be dry, firm and proper for bond.
   a. Treat gypsum wallboard surfaces with a primer-sealer; caulk openings around pipes and fixtures with a non-hardening waterproof sealant.
   b. Apply leveling coat of sanded dry-set mortar over irregular surfaces if and as required to secure plumb, flat surfaces for the application of tile.
5. Mix and apply mortar and adhesive in conformance with best trade practice and the recommendations of the manufacturer of the materials used. Cover surfaces evenly, with no bare spots, and comb with a notched trowel within 10 minutes of applying tile.
6. Apply tile before skinning of the adhesive or mortar has taken place. Press and beat firmly into place to obtain at least 75 percent contact area of adhesive or mortar on the tile back.
7. If tile is face mounted, remove paper and glue before the adhesive or mortar is firmly set; adjust tiles that are out of line.
8. Provide control joints at all inside corners of wall tile areas. Install sealant in joint. Color as selected by Architect.

E. Grouting:
1. Force a maximum amount of grout into the joints.
2. Clean the joints of cushion-edge tile to depth of cushion. Fill joints of square-edge tile flush with face of tile.
3. Fill all gaps and skips. Mortar shall not show through grouted joints.
4. Finished grout shall be uniform in color, smooth, and without voids and low spots.
5. Grout joint width as recommended by tile manufacturer.
6. Damp cure Portland cement grout for at least 72 hours.

F. Wall Control Joints:
1. Provide a caulked control joint at same width as grout joints, minimum of 1/8”.
2. After tile work and grout are dry, clean the open control joint and roll-in foam rod stock to leave a joint depth of 1/4".
3. Fill the joint with primerless one-part acrylic polymeric sealant. Color shall be as selected by Architect.
4. Tool the sealant smooth.
5. Where tile on wallboard abuts tile on masonry, provide a 1/4" caulked control joint to separate the two areas.

G. Joints at Frames: Where ceramic tile abuts frame, provide a minimum 1/8" caulked expansion joint to separate tile from the frame.
1. After tile work and grout are dry, clean the joint at the frame.
2. Fill the joint with primerless one-part acrylic polymeric sealant.
3. Color shall be as selected by Architect.
4. Tool the sealant smooth.

H. Metal Floor Transition Trim:
1. Provide at transition of ceramic floor tile to lower flooring material (e.g. vinyl composition tile, exposed concrete, etc.) where no marble threshold is detailed.
2. Install as detailed on drawings.
3. Set transition trim prior to installing ceramic floor tile.
4. Set tile up tight to transition trim with a factory cushion edge. Trim shall be flush with top of ceramic tile.
5. After tile work and grout are dry, clean the joint between the trim and the tile.
6. Fill joint between trim and ceramic floor tile with sealant to match grout**.**

3.3 CLEANING

A. When the work of other trades is completed, clean down tile and marble surfaces and leave in first class condition.
1. The use of wire brushes or acids is expressly prohibited.
2. Replace cracked, broken, and chipped tile with new units.
3. Correct uneven and stained joints.

END OF SECTION

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SECTION 09 51 00

ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical panels and exposed suspension systems, with and without perimeter trim, for ceilings.

1.2 SUBMITTALS

A. Samples: Submit in accordance with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES. Submit a 12" x 12" sample of each type of acoustic panel. Submit a 6" long sample of each component of each type of exposed suspension system.

1.3 QUALITY ASSURANCE

A. Erector Qualifications: This work shall be performed by an experienced erector approved by the acoustical material manufacturer.

B. Pre-ceiling conference:
1. Prior to start of ceiling grid installation, convene pre-ceiling conference at project site.
2. Attendance is required by Contractor, installer, and Architect.
3. Review specifications and drawings of ceiling installation and layout.

1.4 PROJECT CONDITIONS

A. Environmental Requirements:
1. Before acoustical work is started, all wet work such as concrete and plastering shall be completed and thoroughly dried out.
2. Acoustical ceiling shall not begin until building has been closed to the weather and suitable mechanical ventilation is supplied to maintain condition ranges of 60°F. to 85°F. at not more than 70% R.H. These conditions shall be maintained prior to, during, and after installation.
3. Acoustical panels shall be unpacked and allowed to stabilize for a period of 72 hours, in the environment as defined above, prior to installation.

B. Work Sequence:
1. Do not start acoustical work until mechanical and electrical work to be covered up has been inspected and approved.
2. Coordinate the related work of other trades involved in the ceiling installation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Store tile and panel cartons open at each end to stabilize moisture content.

1.6 WARRANTY

A. Acoustic Lay-in Panels: Submit manufacturer's standard 10-year warranty against sagging or warping (defined as greater than 1/8" measured in the panel center) from the date of installation.

1.7 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver maintenance materials to the project site, packaged with protective covering for storage and identified with appropriate labels. Furnish two boxes of full size acoustical ceiling units of each type installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acoustical Lay-in Panels: ASTM E 1264, mineral fiber panels, Class A (non-combustible) and having an NRC range of min. 0.50-0.60.
   1. Sizes:
      a. 24" x 24" x 5/8".
   2. Design: Fine, non-directional fissured surface.
   3. Finish: Washable factory applied vinyl latex paint.
   4. Edges: Square.
   5. Product/manufacturer; standard panels:
      Fine Fissured Humiguard; Armstrong World Industries, Inc.
      Fine Fissured Safetone; CertainTeed Architectural
      Radar ClimaPlus; USG Interiors, Inc.

B. Suspension System; Acoustic Lay-in Panels: 15/16” Exposed type for panel ceilings as manufactured by the ceiling panel manufacturer or one of the following:
      Armstrong World Industries, Inc.
      CertainTeed Architectural
      Chicago Metallic Corp./Rockfon
      USG Interiors, Inc.
   1. Components shall be roll-formed from steel to meet ASTM C 635 and conform to the requirements for Intermediate duty structural classification. Exposed main tee runners shall be double web with capped face.
   2. Provide single tee adapter clips/unopposed tee clips at off-module cross tee connections where the cross tees intersect a main tee and is not locked into place with another cross tee.
   3. Components shall be electro-zinc coated or hot-dip galvanized and exposed surfaces shall have white enamel finish.
   4. System shall be designed and sized to support the ceiling assembly with a maximum deflection of L/360 of the span.
   5. Color shall be white to match color of lay-in panels.

C. Vinyl Covered Lay-In Gypsum Board Panels: Provide fine texture white vinyl faced gypsum board panels.
   1. Sizes: 24" x 24" x 1/2"
   2. Product/manufacturer; one of the following:
      Ceramaguard Non Perforated; Armstrong World Industries, Inc.

D. Pre-finished extruded aluminum edge trim for suspended acoustical ceilings in a “cloud” configuration.
   1. Provide Armstrong Axiom Knife Edge, 5” vertical leg, 6” horizontal leg.
      a. Provide factory bonded corners.
      b. Provide accessories as required.
      c. Refer to Material Finish Schedule in drawings for color.

E. Suspension System: 15/16” Vinyl Covered Gypsum Board Ceilings: ASTM C 635, heavy duty, 15/16" hot dipped galvanized steel, with aluminum cap with white finish. Product/manufacturer: one of the following:

   Prelude Plus XL Fire Guard Environmental Tee System; Armstrong World Industries

   DXLA DONN Brand Acoustical Suspension System; USG Interiors, Inc.

F. Hangers: 12 gage annealed and galvanized steel wire.

G. Hold-down Clips: UHDC Universal Hold Down Clip by Armstrong.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive acoustical treatment for conditions that will adversely affect the execution and quality of work. Designate any areas of potential interference between ceiling components and components of other trades. Do not start this work until unsatisfactory conditions are corrected.

3.2 CEILING INSTALLATION

A. General: Installation procedures shall meet or exceed the manufacturer's recommendations and ASTM C 636.
   1. Lay out each area so that the panel patterns are symmetrical, joints parallel to walls and borders generally equal in width.
   2. Coordinate the patterns with ceiling lights and grilles in conformance with the reflected ceiling plans and as directed.
   3. Verify types and sizes of light fixtures and grilles to be accommodated and arrange the work accordingly.

B. Suspension: Locate main and cross tee runners to form the indicated patterns.
   1. Use a laser leveling method to direct-suspend the main tees with hangers spaced not more than 48" o.c.
   2. Provide hangers within 6" of the corners of recessed lighting fixtures.
   3. Under steel construction, wrap hangers around or clip or bolt hangers to a structural steel member (not steel deck).
   4. Under bar joists, suspend hangers from top chord or from bottom chord at panel points only.
   5. Under ductwork, employ trapeze system for hanging ceiling.
   6. Do not suspend hangers from ducts, piping, conduit, or fireproofing membrane.
   7. Use a laser beam system to level the main tee runners to within 1/8" in 12 ft. Level with hangers taut; do not make kinks or bends in hangers as a means of leveling.

C. Moldings: Install finish channel and angle moldings where ceilings abut walls, furrings and other intersecting vertical surfaces.
   1. Moldings shall be in long lengths, secured to adjoining surfaces with at least two fasteners for each piece or more as may be required. Pull the molding snugly against the vertical surface without any gaps.
   2. No molding length shall be less than 3 ft. except at short offsets.
   3. Use prefabricated corner pieces where possible to eliminate field mitering.

D. Perimeter edge trim at “cloud” ceilings.
   1. Comply with manufacturer’s written instructions for layout and installation.

E. Lay-in Panels: Install the acoustic panels in the exposed suspension system with bottom surfaces flush and in a true, level plane.
   1. Hold-down clips are required at all vinyl covered gypsum panels for cleaning purposes.
   2. Provide hold-down clips at lay-in panels within 6' of exterior exits.

F. Access: Provide access through acoustic panel ceilings with one or more access locations in each room to maintain a maximum spacing of 30 ft. between access panels.

3.3 TOLERANCES

A. Variation from flat and level surface: 1/8 inch in 10 ft.

B. Variation from plumb of grid members caused by eccentric loads: Two degrees (2°) maximum.

3.4 ADJUSTING AND PATCHING

A. Replace damaged members of exposed suspension system. Replace ceiling board and tile that is damaged, installed improperly, or shows visible signs of sagging.

3.5 CLEANING

A. After installation, clean soiled and discolored surfaces. Remove damaged units and replace with new.

END OF SECTION

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SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Vinyl composition tile flooring, rubber base, and accessories.

1.2 SUBMITTALS

A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit manufacturer's standard color samples of tile, not less than 3" x 3", full thickness. Submit samples of each accessory, full height or width by not less than 2" length.

B. Concrete Slab Testing
   1. Alkalinity and Adhesion Testing:
      a. Submit result of pH tests.
      b. Submit written documentation of acceptable pH levels of selected flooring manufacturer.
      c. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.
      d. Proceed with installation only after substrates pass testing.
   2. Relative Humidity Probe Tests:
      a. Submit results for in situ relative humidity probe tests.
      b. Submit date and time measurements were made.
      c. Submit locations and depth of probe holes.
      d. Submit temperature and relative humidity in each probe hole.
      e. Submit ambient air temperature.
      f. Acceptable relative humidity is typically 75% or less. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have relative humidity percentage stated as acceptable by manufacturer.
      g. Submit letter from flooring manufacturer stating that relative humidity is acceptable and manufacturer will issue warranty.
   3. Anhydrous Calcium Chloride Testing
      a. Submit time and date of placement and retrieval.
      b. Submit ambient air temperature and humidity during test duration
      c. Submit manufacturer’s instructions and relative technical data.
      d. Acceptable moisture emission rates are typically 3 Ibs. per 1000 sq. ft. or less, in 24 hours. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
      e. Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.

1.3 QUALITY ASSURANCE

A. Pre-Tread Installation Conference:
   1. At least one week prior to the start of flooring installation, the contractor shall convene a pre-installation conference at the project site.
   2. Attendance is required by the Contractor, installer, and manufacturer’s technical representative. The Architect and Owner shall be invited.
   3. Review requirements for work and conditions which could possibly interfere with successful performance of work.

B. Color Uniformity: Provide rubber base, stair treads, and rubber flooring from the same manufacturer.

1.4 DELIVERY

A. Deliver floor materials to the project site in unbroken containers and cartons bearing the manufacturer's labels.

B. Deliver resilient floor materials to an acclimatized building at least 36 hours prior to installation of vinyl composition tile.

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Maintain the temperature inside the building reasonably constant at not less than 65°F. for 48 hours before installation, during installation, and for 48 hours after installation.

B. After installation, maintain temperatures within range recommended by manufacturer, but not less than 55°F. or more than 95°F.

1.6 WARRANTY

A. Luxury Vinyl Tile: Provide manufacturer's standard 10 Year Commercial Warranty.

B. Rubber Base Warranty: Provide Standard 2-year manufacturers' warranty that materials is free from manufacturing defects.

C. Rubber Flooring Warranty: Provide rubber flooring manufacturer's standard written 10-Year Wear Warranty.

1.7 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to the project site not less than one box for each 50 boxes or fraction thereof, for each type, color, pattern, and size installed. Furnish maintenance materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identifying labels.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Luxury Vinyl Tile: ASTM F 1700, Class 3, Type B, 6" x 48", Basis of Design is Event Abstract Pete Texterran+ as manufactured by Tarkett. Color as scheduled in MATERIAL FINISH SCHEDULE in the drawings.

B. Rubber Base: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Style Cove (with top-set toe), 1/8" thick, 4" high. Color(s) as scheduled in MATERIAL FINISH SCHEDULE in the drawings. Furnish base in manufacturer's continuous rolls. Outside corners shall be factory formed pre-molded units matching base in color and finish. Product/manufacturer; one of the following:
Basis of Design: Pinnacle Cove, Roppe
Tarkett/Johnsonite
NO SUBSTITUTIONS on Type TS (rubber, vulcanized thermoset)

C. Edge Strips: 1" wide by 1/8" thick black rubber tile reducer with beveled surface.

D. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic cement based formulation provided or approved by vinyl composition tile manufacturer.

E. Adhesive: Moisture-resistant type recommended by flooring manufacturer. Use an epoxy adhesive at rubber treads, risers and flooring as recommended by manufacturer. Provide epoxy nose caulking as recommended by manufacturer.

F. Cleaner: Neutral, chemical cleaner such as Hillyard "Super Shine-All" designed to be safe to use on any surface not damaged by water.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive resilient flooring, base, and accessories for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Testing of concrete slabs
   1. Anhydrous Calcium Chloride Testing
      a. Conduct anhydrous calcium chloride testing per ASTM F1869, modified to include testing over concrete containing lightweight aggregate.
      b. Environmental requirements of area to be tested are to match that of the finished floor covering. Doors, windows, roofing, etc. must be installed and the temperature of the building controlled to a finished building atmosphere. Ensure interior building climate is 75 degrees F ± 10 degrees F and 50% Relative Humidity ± 10% for 72 hours prior to, and throughout the duration of the tests.
      c. The number of test kits required is determined by the square footage of areas scheduled to receive finish flooring. A minimum of three test kits are required in the first 1,000 sq. ft. a minimum of one test kit per each additional 1,000 sq. ft. with consideration given to separation of test areas. Time of exposure is a minimum of 60 hours and a maximum of 72 hours.
      d. A prepackaged calcium chloride test kit is equipped with a sealed dish of anhydrous calcium chloride, a metering dome with gasket and instructions.
         1) Clean substrate in area to be tested by removing dust solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, curing, sealing, hardening, or parting compounds, alkaline salts, excessive carbonation, or laitance, mold mildew and other foreign materials.
         2) Weigh the tape sealed dish on a gram scale with 1/10th gram gradation. Record start weight, date and time on dish's label and instruction document.
         3) Unseal dish and expose test according to preprinted test kit instructions.
         4) Allow 60 to 72 hours of exposure. Retrieve test dish re-seal and re-weigh according to instructions.
         5) Provide a diagram of the building, with calculations, documenting each test location with its results in writing.
      e. Acceptable moisture emission rates are typically 3 lbs. per 1000 sq. ft. or less, in 24 hours; however, submit written tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
      f. Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.
   2. In Situ Relative Humidity Probe Test:
      a. Conduct in situ relative humidity probe testing per ASTM F2170.
      b. Concrete floor slabs shall be at the service temperature and the occupied air space above the slab shall be at the service temperature service relative humidity far at least 48 hours before taking relative humidity measurements in the concrete slab.
      c. Perform 3 tests for the first 1,000 sq/ft. and a minimum of 1 test for every 1,000 sq/ft. thereafter.
      d. For slabs on-grade and below-grade choose a testing location within 3 feet of each exterior wall.
      e. Drill probe holes 40% into depth of slab for slabs drying from the top only and 20% into the slab for slabs drying from top and bottom.
      f. Remove dust from hole using vacuum cleaner and allow 72 hours to achieve moisture equilibration within hole before taking relative humidity measurements.
      g. After inserting probe allow necessary amount of time for probe to reach temperature equilibrium before measuring relative humidity.
      h. Use the relative humidity probe to measure the ambient air temperature and relative humidity above the slab in the vicinity of the hole.
      i. Proceed with installation only after substrates pass testing.
      j. Submit letter from flooring manufacturer stating that floor relative humidity percentage is acceptable and manufacturer will issue warranty.
   3. Alkalinity and Adhesion Testing
      a. Conduct pH test per ASTM F710.
      b. Test for alkalinity prior to installation of flooring materials.
      c. pH levels shall not exceed the written recommendation of the flooring manufacturer and the adhesive manufacturer.
      d. A pH range of 5-9 is optimum, not to exceed 9 pH. Submit written acceptable pH levels of selected flooring manufacturer.
      e. Proceed with installation only after substrates pass testing.
      f. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.

B. Concrete Substrates: Prepare according to ASTM F 710.
   1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners. Surfaces shall be clean and dry before flooring is laid.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Sweep the surfaces free of dust and dirt and remove oil, grease, paint, dried mortar and curing compound residue.
4. Fill low spots, cracks, minor holes and crevices in concrete floors with latex underlayment patching material. Re-surface rough and irregular surfaces with the same underlayment material.

3.3 INSTALLATION

A. Laying Flooring:
1. Install floor tile in straight joint pattern as directed and in conformance with the manufacturer's recommended procedure.
2. Start at centerlines of spaces and adjust borders to maintain full tiles in the field and equal borders. Except as required in irregularly shaped areas, no tile shall be less than one-half the width of field tile, and in no event shall any tile piece be less than 3" wide.
3. Install tile to square grid pattern with all joints aligned, with pattern grain alternating with adjacent unit to produce basket weave pattern. Allow minimum 1/2 full size tile width at room or area perimeter. Lay tile starting at center of room working toward walls, square with room axis. Joints shall be tight butt joints, true to line.
4. Terminate flooring at centerline of door openings where adjacent floor finish is dissimilar.
5. Install edge strips at unprotected or exposed edges and where flooring terminates.
6. Bed tile firmly and maintain joints tight, straight, and square with the room axes. The completed surfaces shall be free of buckles, waves, and projecting tile. Scribe tiles neatly at columns, corners, and casework.
7. Where flooring edges are not concealed by thresholds or other materials, install rubber edge strips.

B. Applying Rubber Base:
1. Install coved base after the floor tile, mat, and carpet have been laid. Do not use less than manufacturer's continuous rolls, except where required for last piece in any one run of wall length.
2. Apply base with adhesive covering 100% of the back surface, not just in spots. Apply adhesive with a notched trowel. Use headless brads in addition to adhesive where required. Use preformed outside corners and miter inside corners. Joints shall be tight.
3. Fit joints tight and vertical. Maintain minimum measurement of 18 inches between joints.

3.4 PROTECTION

A. Prohibit traffic on floor finish for 48 hours after installation.

B. Repair or replace damaged surfaces that are soiled or scarred in a manner acceptable to the Owner.

3.5 CLEANING

A. Clean in accordance with Section 01 74 13 - PROGRESS CLEANING.
1. Remove excess adhesive and other foreign matter from tile flooring and base.
2. Scrub floor with cleaner in conformance with manufacturer's instructions and rinse.
3. Replace defective or loose material.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Decorative epoxy-resin flooring consisting of colored quartz aggregate in an epoxy matrix with integral cove base.

B. Related Sections:
   1. Section 09 62 05 - Moisture Vapor Emission and Alkalinity Control.

1.2 SUBMITTALS

A. Product Data: For each type of product specified. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples for Verification: Of each resinous flooring system required, 6 inches square, applied by Installer for this Project to a rigid backing, in color, texture, and finish indicated. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

C. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

D. Material Test Reports: From a qualified independent testing agency indicating and interpreting test results of the resinous flooring's reaction to chemicals and other reagents and substantiating compliance with requirements.

E. Material Certificates: In lieu of material test reports, when permitted by Architect, signed by manufacturers certifying that materials furnished comply with requirements.

F. Concrete Slab Testing
   1. Alkalinity and Adhesion Testing:
      a. Submit result of pH tests.
      b. Submit written documentation of acceptable pH levels of selected flooring manufacturer.
      c. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.
      d. Proceed with installation only after substrates pass testing.
   2. Relative Humidity Probe Tests:
      a. Submit results for in situ relative humidity probe tests.
      b. Submit date and time measurements were made.
      c. Submit locations and depth of probe holes.
      d. Submit temperature and relative humidity in each probe hole.
      e. Submit ambient air temperature.
      f. Acceptable relative humidity is typically 75% or less. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have relative humidity percentage stated as acceptable by manufacturer.
      g. Submit letter from flooring manufacturer stating that relative humidity is acceptable and manufacturer will issue warranty.
   3. Anhydrous Calcium Chloride Testing
      a. Submit time and date of placement and retrieval.
      b. Submit ambient air temperature and humidity during test duration.
      c. Submit manufacturer's instructions and relative technical data.
      d. Acceptable moisture emission rates are typically 3 lbs. per 1000 sq. ft. or less, in 24 hours. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
      e. Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who has specialized in installing resinous flooring similar in material, design, and extent to that indicated for this Project and who is acceptable to resinous flooring manufacturer. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to install resinous flooring systems specified.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.

C. Field Samples: On floor area selected by Architect, provide full-thickness resinous flooring system samples that are at least 48 inches square to demonstrate texture, color, thickness, chemical resistance, cleanability, and other features of each resinous flooring system required. Simulate finished lighting conditions for review of in-place field samples.
   1. If field samples are unacceptable, make adjustments to comply with requirements and apply additional samples until field samples are approved.
   2. After field samples are approved, these surfaces will be used to evaluate resinous flooring.
   3. Obtain Architect's approval of field samples before applying resinous flooring.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work Include, but are not limited to:
   Basis of Design: Dex-O-Tex Decor Flor as manufactured by Crossfield Products Corp. (phone 310.886.9100 web site: www.dexotex.com)
   Dur-A-Flex, Inc. (phone 800.253.3539 web site: www.dur-a-flex.com)
   General Polymers, Inc., Division of Sherwin-William (phone 800.543.7694 web site: www.generalpolymers.com
   Harris Specialty Chemicals, Inc. (phone 800.322.7825)
   Key Resin Company (phone 888.943.4532 web site: www.keyresin.com)
   Neogard, Division of Jones-Blair (phone 800.321.6588 web site: www.neogard.com)
   Palma Inc. (phone 800.336.7256 web site: www.palmainc.com)
   RBC Industries, Inc. (phone 888.722.3769 www.rbcepoxy.com/index2.htm
   Silikal Resin Systems (phone 800.477.4545 we site: www.silikalresins.com)
   Stonhard (phone 800.257.7953 web site: www.stonhard.com)
   1. Color and Pattern: As scheduled in MATERIAL FINISH SCHEDULE in drawings.
   2. Total Thickness of Body Coat(s): As recommended by manufacturer for system compliance with requirements.
   3. System Thickness: Minimum 1/8 inch.

4. Wearing Surface: Antislip.
5. Base: 4 inch high integral cove base.
6. Components: Provide manufacturer's standard components complying with requirements, unless otherwise indicated. Provide the following optional components where recommended by the manufacturer for intended uses and locations:
   a. Primer.
   b. Reinforcing membrane.
   c. Chemical-resistant sealing or finish coat(s).

B. Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to standard test methods indicated:
1. Compression Strength: 12,500 psi per ASTM C 579.
2. Tensile Strength: 2,600 psi per ASTM C 307.
3. Flexural Modulus of Elasticity: 4,500 psi per ASTM C 580.
4. Water Absorption: 0.04 percent maximum per ASTM D 570.
5. Indentation: 0.025 percent maximum per MIL-D-3134.
6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
7. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch per MIL-D-3134.
8. Abrasion Resistance: 24 mg maximum weight loss per ASTM D 2047.
9. Flammability: Self-extinguishing per ASTM D 635.
10. Hardness: 75-80, Shore D per ASTM D 2240.
11. Bond Strength: 400 psi, 100 percent concrete failure per ACI 503R.

C. Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 543, Procedure A, for immersion in the following reagents for not less than 7 days:
1. Ammonium hydroxide, carbon tetrachloride, citric acid, dimethyl formamide, formaldehyde (3%), heavy-duty detergent, heptane, hydrogen peroxide (28%), lactic acid, oleic acid, phenol solution, sodium carbonate (20%), sodium chloride (10%), sodium hydroxide (60%), sodium hypochlorite, sulfuric acid (30%), urine.

2.2 MATERIALS

A. Resinous Flooring: Resinous floor surfacing system consisting of primer; body coat(s) including resin, hardener, aggregates, and colorants, if any; and sealing or finish coat(s).
1. Reinforcing Membrane: Manufacturer's flexible resin recommended for crack isolation to help prevent substrate cracks from reflecting through resinous flooring.

B. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

C. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

D. Accessories for integral cove base:
1. Manufacturer's standard filler to form cove portion of integral base.
2. Manufacturer's standard aluminum extrusion at top of integral base.

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrate according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral substrate for resinous flooring application.

B. Testing of concrete slabs
1. Anhydrous Calcium Chloride Testing
   a. Conduct anhydrous calcium chloride testing per ASTM F1869, modified to include testing over concrete containing lightweight aggregate.
   b. Environmental requirements of area to be tested are to match that of the finished floor covering. Doors, windows, roofing, etc. must be installed and the temperature of the building controlled to a finished building atmosphere. Ensure interior building climate is 75 degrees F ± 10 degrees F and 50% Relative Humidity ± 10% for 72 hours prior to, and throughout the duration of the tests.

c. The number of test kits required is determined by the square footage of areas scheduled to receive finish flooring. A minimum of three test kits are required in the first 1,000 sq. ft. a minimum of one test kit per each additional 1,000 sq. ft. with consideration given to separation of test areas. Time of exposure is a minimum of 60 hours and a maximum of 72 hours.
d. A prepackaged calcium chloride test kit is equipped with a sealed dish of anhydrous calcium chloride, a metering dome with gasket and instructions.
    1) Clean substrate in area to be tested by removing dust solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, curing, sealing, hardening, or parting compounds, alkaline salts, excessive carbonation, or laitance, mold mildew and other foreign materials.
    2) Weigh the tape sealed dish on a gram scale with 1/10th gram gradation. Record start weight, date and time on dish's label and instruction document.
    3) Unseal dish and expose test according to preprinted test kit instructions.
    4) Allow 60 to 72 hours of exposure. Retrieve test dish re-seal and re-weigh according to instructions.
    5) Provide a diagram of the building, with calculations, documenting each test location with its results in writing.
e. Acceptable moisture emission rates are typically 3 lbs. per 1000 sq. ft. or less, in 24 hours; however, submit written tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
f. Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.

2. In Situ Relative Humidity Probe Test:
    a. Conduct in situ relative humidity probe testing per ASTM F2170.
    b. Concrete floor slabs shall be at the service temperature and the occupied air space above the slab shall be at the service temperature service relative humidity far at least 48 hours before taking relative humidity measurements in the concrete slab.
    c. Perform 3 tests for the first 1,000 sq/ft. and a minimum of 1 test for every 1,000 sq/ft. thereafter.
    d. For slabs on-grade and below-grade choose a testing location within 3 feet of each exterior wall.
    e. Drill probe holes 40% into depth of slab for slabs drying from the top only and 20% into the slab for slabs drying from top and bottom.
    f. Remove dust from hole using vacuum cleaner and allow 72 hours to achieve moisture equilibration within hole before taking relative humidity measurements.
    g. After inserting probe allow necessary amount of time for probe to reach temperature equilibrium before measuring relative humidity.
    h. Use the relative humidity probe to measure the ambient air temperature and relative humidity above the slab in the vicinity of the hole.
    i. Proceed with installation only after substrates pass testing.
    j. Submit letter from flooring manufacturer stating that floor relative humidity percentage is acceptable and manufacturer will issue warranty.
3. Alkalinity and Adhesion Testing
    a. Conduct pH test per ASTM F710.
    b. Test for alkalinity prior to installation of flooring materials.
    c. pH levels shall not exceed the written recommendation of the flooring manufacturer and the adhesive manufacturer.
    d. A pH range of 5-9 is optimum, not to exceed 9 pH. Submit written acceptable pH levels of selected flooring manufacturer.
    e. Proceed with installation only after substrates pass testing.
    f. Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.

C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminates incompatible with resinous flooring.
    1. Comply with ASTM C 811 requirements, unless manufacturer’s written instructions are more stringent.
    2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer’s written recommendations.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer’s written instructions.

E. Use patching and fill material to fill holes and depressions in substrate according to manufacturer’s written instructions.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.
   4. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply reinforcing membrane to substrate cracks or entire substrate surface as recommended by manufacturer.

D. Apply self-leveling slurry body coat(s) in thickness indicated.

E. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.

F. Integral Cove Base, 6" tall: Apply cove base mix to wall surfaces adjacent floor applications unless otherwise indicated. Round internal and external corners. Install cove base according to manufacturer's written instructions and details including taping, mixing, priming, troweling, sanding, and topcoating of cove base.

G. Apply sealing or finish coat(s), including grout coat, if any, of type recommended by resinous flooring manufacturer to produce finish indicated. Apply in number of coats and at spreading rates recommended in writing by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Material Sampling: Owner may at any time and any number of times during flooring application require material samples for testing for compliance with requirements.
   1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified and sealed, and certified in presence of Contractor.
   2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's Product Data.
   3. If test results show installed materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

3.4 CLEANING AND PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

B. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of substantial completion in each project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

END OF SECTION

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SECTION 09 68 00

CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Carpet, including the following:
   1. Surface preparation.
   2. Glue down carpeting on floor surfaces.
   3. Accessories, including edge strips.

B. Related Sections:
   1. Section 09 65 00 - Resilient Flooring: rubber base.

1.2 SUBMITTALS

A. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include manufacturer's installation instructions.

C. Concrete Slab Testing
   1. Alkalinity and Adhesion Testing:
      Submit result of pH tests.
      Submit written documentation of acceptable pH levels of selected flooring manufacturer.
      Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.
      Proceed with installation only after substrates pass testing.
   2. Relative Humidity Probe Tests:
      Submit results for in situ relative humidity probe tests.
      Submit date and time measurements were made.
      Submit locations and depth of probe holes.
      Submit temperature and relative humidity in each probe hole.
      Submit ambient air temperature.
      Acceptable relative humidity is typically 75% or less. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have relative humidity percentage stated as acceptable by manufacturer.
      Submit letter from flooring manufacturer stating that relative humidity is acceptable and manufacturer will issue warranty.
   3. Anhydrous Calcium Chloride Testing
      Submit time and date of placement and retrieval.
      Submit ambient air temperature and humidity during test duration
      Submit manufacturer’s instructions and relative technical data.
      Acceptable moisture emission rates are typically 3 Ibs. per 1000 sq. ft. or less, in 24 hours. Submit written documentation of tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
      Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.

D. Samples for verification purposes in manufacturer’s standard size, showing full range of color, texture, and pattern variations expected. Secure samples from material to be used for the work. Submit the following:
   1. 12" square samples of each type of carpet material required.
   2. 12" long samples of each type of exposed edge striping and accessory item.

E. Seaming Diagrams: Submit to the Architect for review.
   1. Contractor shall be responsible for conformance with the drawings and specifications relative to the installation.
   2. Architect's review will cover the sizes of the pieces and location of seams, but not dimensions or quantities.
   3. All length seams and cross joints necessary to the layout of the carpet shall be shown on the seaming diagrams.

F. Maintenance Manual: Provide 2 copies of a printed maintenance manual, written by the carpet manufacturer's Technical Service Department delivered to the Owner at the project site. Include the following:
   1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
   2. Precautions for cleaning materials and methods that could be detrimental to carpet.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in carpet manufacturing with 5 years minimum experience.

B. Installer Qualifications: An experienced installer with 3 years minimum documented experience in carpeting installations of similar scope.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Carpet shall be delivered to the project site in mill wrappings. Each roll shall have register number tags attached or register number stenciled on bale.

B. Store materials for 3 days prior to installation in the areas of installation to achieve temperature stability.

1.5 PROJECT CONDITIONS

A. Measurements: Dimensions supplied on the drawings are approximate. Contractor shall carefully check dimensions and other conditions affecting his work in the field and shall be responsible for proper installation.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Temperature and Humidity: Carpet must be installed when the indoor temperature is between 65°F. and 95°F. with a maximum relative humidity of 65%. If ambient temperatures are outside these parameters, the installation must not begin until the HVAC system is operational and these conditions are maintained at least 48 hours before, during, and 72 hours after completion.

B. Provide sufficient lighting.

1.7 WARRANTIES

A. Manufacturer's 25-year 10-year warranty, non-prorated, against product failure covering all costs including freight, labor, and material for the following:
   1. Edge Ravel - wet or dry.
   2. Back delamination, wet or dry.
   3. Loss of 20 lb. average tuft bind - wet or dry.
   4. Static protection - 3.0 KV when tested under the Standard Shuffle Test, 70 F - 20% RH
   5. Wear - No more than 10% face yarn loss.
   6. Adhesive failure.

B. Installation Warranty: 5-Year Warranty, non-prorated, against installation related failure covering all costs including freight, labor, and material.

1.8 MAINTENANCE

A. Extra Materials: Upon completion of work, deliver to the project site not less than 12 sq. yds. of each type, color, and pattern of carpet, exclusive of materials required to properly complete installation. Furnish maintenance materials from same production run as materials installed. Package maintenance materials with protective covering, identified with appropriate labels. Other remnants, usable scraps, and overage in carpeting shall be packaged in appropriate wrapping, labeled, and delivered to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Carpet: Provide Ebbing Waves series roll goods as manufactured by Tarkett.
   1. Color shall be as scheduled in the MATERIAL FINISH SCHEDULE in the drawings.
   2. Appearance Retention; one of the following:
      ASTM D-7330 Method for Assessment of Surface Appearance Change in Pile Yarn Floor Coverings (Hexapod Test): Minimum 3.0 rating for heavy traffic.
      ASTM D5417 Vetterman Drum Test for 22,000 cycles. A minimum rating of 3.0 using CRI TM-101 Reference Scale.

B. Walk-Off Carpet: Provide Assertive Action series roll goods as manufactured by Tarkett.
   1. Color shall be as scheduled in MATERIAL FINISH SCHEDULE in drawings.

C. Substrate Filler: As recommended by adhesive and carpet manufacturer; compatible with substrate.

D. Adhesive: As recommended by the carpet manufacturer.

E. Edge Strips: Provide two-piece vinyl Joining Moulding, No. 365 'T' with No. 970 Track as manufactured by Burke Flooring, a Division of Burke Industries, (phone 800.669.7010 web site: www.burkeflooring.com). Color(s) as selected by Architect.

F. Miscellaneous Materials: Types of seam sealers, thread, and other accessory items recommended by the carpet manufacturer and installer for the conditions of installation and use.

PART 3 - EXECUTION

3.1 INSPECTION

A. Before commencement of work the Contractor shall inspect the floors to receive carpet to determine the condition of those surfaces, and shall furnish and apply suitable primer and otherwise prepare floor surfaces in accordance with the carpet manufacturer's instruction.

3.2 PREPARATION

A. Delay installation until surrounding work, including painting, has been completed. Vacuum substrate immediately prior to carpet installation, and remove deleterious substances which would interfere with installation or be harmful to the work.

B. Ensure floors are level, with maximum surface variation of 1/4 inch in 10 feet noncumulative. Inspect subflooring for cracks, holes, abrasions, rough spots, ridges, or other conditions which will adversely affect execution and quality of work.

C. Ensure concrete floors are free from scaling and irregularities and exhibit neutrality relative to acidity and alkalinity.

D. Use an approved cementitious filler to patch cracks, small holes, and for leveling.

E. Notify Architect in writing of conditions which will prevent satisfactory completion of work. Do not proceed until such defects are entirely corrected. Application or installation of carpet shall constitute acceptance of sub- floors.

F. Relaxing/Conditioning Carpet: To minimize wrinkling and buckling, and to facilitate installation, carpet shall be unrolled and allowed to relax in the installation area for a minimum of 24 hours **[72 hours (vinyl-back carpet)]** at a temperature between 65°F. and 95°F. Carpet must be adequately protected from soil, dust, moisture and other contaminants.

G. Testing of concrete slabs
   1. Anhydrous Calcium Chloride Testing
      Conduct anhydrous calcium chloride testing per ASTM F1869, modified to include testing over concrete containing lightweight aggregate.
      Environmental requirements of area to be tested are to match that of the finished floor covering. Doors, windows, roofing, etc. must be installed and the temperature of the building controlled to a finished building atmosphere. Ensure interior building climate is 75 degrees F ± 10 degrees F and 50% Relative Humidity ± 10% for 72 hours prior to, and throughout the duration of the tests.
      The number of test kits required is determined by the square footage of areas scheduled to receive finish flooring. A minimum of three test kits are required in the first 1,000 sq. ft. a minimum of one test kit per each additional 1,000 sq. ft. with consideration given to separation of test areas. Time of exposure is a minimum of 60 hours and a maximum of 72 hours.
      A prepackaged calcium chloride test kit is equipped with a sealed dish of anhydrous calcium chloride, a metering dome with gasket and instructions.
      1) Clean substrate in area to be tested by removing dust solvent, paint, wax, oil, grease, residual adhesive, adhesive removers, curing, sealing, hardening, or parting compounds, alkaline salts, excessive carbonation, or laitance, mold mildew and other foreign materials.
      2) Weigh the tape sealed dish on a gram scale with 1/10th gram gradation. Record start weight, date and time on dish's label and instruction document.
      3) Unseal dish and expose test according to preprinted test kit instructions.
      4) Allow 60 to 72 hours of exposure. Retrieve test dish re-seal and re-weigh according to instructions.
      5) Provide a diagram of the building, with calculations, documenting each test location with its results in writing.
      Acceptable moisture emission rates are typically 3 Ibs. per 1000 sq. ft. or less, in 24 hours; however, submit written tolerances for selected flooring manufacturer. Proceed with installation only after substrates have maximum moisture-vapor-emission rate as stated by manufacturer.
      Submit letter from flooring manufacturer stating that floor moisture emission rates are acceptable and manufacturer will issue warranty.
   2. In Situ Relative Humidity Probe Test:
      Conduct in situ relative humidity probe testing per ASTM F2170.
      Concrete floor slabs shall be at the service temperature and the occupied air space above the slab shall be at the service temperature service relative humidity far at least 48 hours before taking relative humidity measurements in the concrete slab.
      Perform 3 tests for the first 1,000 sq/ft. and a minimum of 1 test for every 1,000 sq/ft. thereafter.
      For slabs on-grade and below-grade choose a testing location within 3 feet of each exterior wall.
      Drill probe holes 40% into depth of slab for slabs drying from the top only and 20% into the slab for slabs drying from top and bottom.
      Remove dust from hole using vacuum cleaner and allow 72 hours to achieve moisture equilibration within hole before taking relative humidity measurements.
      After inserting probe allow necessary amount of time for probe to reach temperature equilibrium before measuring relative humidity.
      Use the relative humidity probe to measure the ambient air temperature and relative humidity above the slab in the vicinity of the hole.
      Proceed with installation only after substrates pass testing.
      Submit letter from flooring manufacturer stating that floor relative humidity percentage is acceptable and manufacturer will issue warranty.
   3. Alkalinity and Adhesion Testing
      Conduct pH test per ASTM F710.
      Test for alkalinity prior to installation of flooring materials.
      pH levels shall not exceed the written recommendation of the flooring manufacturer and the adhesive manufacturer.
      A pH range of 5-9 is optimum, not to exceed 9 pH. Submit written acceptable pH levels of selected flooring manufacturer.
      Proceed with installation only after substrates pass testing.
      Submit letter from flooring manufacturer stating that floor alkalinity is acceptable and manufacturer will issue warranty.

3.3 INSTALLATION

A. Install carpet using the direct cement method.
   1. Comply with carpet manufacturer's written instruction and recommendations. Maintain direction of pattern and texture throughout the entire building. Do not seam weft to warp, except as directed by Architect.

2. Extend carpet under open-bottomed and raised-bottom obstructions, and under removable flanges of obstructions. Extend carpet into closets and alcoves of rooms indicated to be carpeted, unless another floor finish is indicated for such spaces. Extend carpet under movable furniture and equipment.
3. Install carpet wall to wall, using continuous lengths and as broad widths as possible to minimize the placement of seams in traffic lanes. Cut edges shall be trued and appropriately treated to form invisible and non-raveling joints where exposed.
4. Edges of carpet abutting vertical surfaces shall fit tight and meet against such materials. Where carpet edges are not concealed by thresholds or other materials use vinyl edge strips.
5. In corridors, run carpet length parallel to the corridor walls. At corridor intersections, carpet shall change direction.
6. Installed carpet shall be free of spots, dirt or soil, and shall be without tears, frayed or pulled tufts. Carpet surfaces shall be smooth and tight, without wrinkles and open seams.

B. Check matching of carpet before cutting and ensure there is no visible variation between dye lots.

C. Double-cut carpet seams, where required, in manner to allow proper seam and pattern match. Ensure cuts are straight and true and unfrayed.

D. Seams
1. Install in accordance with approved seam layout using a minimum of seams. Where possible and practical, locate seams in areas of least amount of traffic.
2. Do not use small carpet fill strips.
3. Do not place seams perpendicular to doors or entries.
4. Cross joints necessary due to layout of areas shall be at absolute minimum and shall be indicated on shop drawings.
5. Cross joins necessary due to length of rolls received shall be placed, in the cutting, to avoid occurrence at conspicuous locations, near doors or at pivot points, and shall be approved prior to seaming.
6. Join seams in recommended manner so as not to detract from the appearance of the carpet installation and decrease its life expectancy. Ensure seams are straight, not overlapped or peaked and free of gaps.
7. Chemically or mechanically weld seams with manufacturer's recommended seam sealer as stated in installation instructions. Make sure the seams are fully sealed/welded.
8. Roll with appropriate roller for complete contact of hardback carpet with mill-applied adhesive to sub-floor.
9. When recommended by manufacturer, backing should be rolled according to manufacturer's instructions to assure transfer of the adhesive between floor and carpet backing.
10. When required by the manufacturer's warranty, the manufacturer's recommended seam sealer must be applied to cut edges of carpet to prevent seam failure.

E. Vacuum clean substrate. Spread adhesive in quantity recommended by manufacturer after primer application to ensure proper adhesion over full area of installation. Apply only enough adhesive to permit proper adhesion of carpet before initial set.

F. Lay carpet on floors with the run of the pile in same direction of anticipated traffic. Lay carpet on stairs with run of the pile in opposite direction of anticipated traffic to avoid peeking of backing at nosing.

G. Do not change run of pile in any one room or from one room to next where continuous through a wall opening.

3.4 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

3.5 PROTECTION

A. Prohibit traffic from carpet areas for 24 hours after installation.

END OF SECTION

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SECTION 09 72 21

SANITARY WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pre-finished fiberglass reinforced panels (FRP).

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, SAMPLES.

B. Samples: Submit sample of each type of panel.

C. Maintenance Instructions: Submit copies of the manufacturer's printed instructions for maintenance of the installed work.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing commercial pre-finished panels with 5 years documented experience.

B. Applicator Qualifications: Work shall be performed by a skilled applicator having at least five years experience in the installation of pre-finished panels.

C. Source Quality Control: Flame spread rating of the material shall be determined by ASTM E 84. Each roll of goods delivered to the project shall bear Underwriters' Laboratories labels.

1.4 REGULATORY REQUIREMENTS

A. Conform to applicable building code for flame spread/fuel contribution/smoke development ratings when tested to ANSI/ASTM E 84.

1.5 ENVIRONMENTAL CONDITIONS

A. Building should be fully enclosed prior to installation with sufficient heat and ventilation.

B. Room temperature during installation must be 70°F. or above.

C. Panels should be allowed to equalize to the moisture in the room environment prior to installation.

1.6 DELIVERY AND STORAGE

A. Materials should be stored lying flat, under cover and protected from the elements. Panels should be allowed to acclimate to the room conditions for 48 hours prior to installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Prefinished Panels
   1. Provide FRP Panels as manufactured by Marlite or approved equivalent.
   2. Finish: Color and finish as selected by Architect from manufacturer's full color and pattern range.

B. Moldings and Trim Pieces: Inside Corner, Division and End Cap moldings. Provide all moldings required for a complete installation.

C. Adhesive: Type and brand recommended by the panel manufacturer.

D. Sealant: Silicone sealant as recommended by the panel manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to receive panels for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

B. Verify that substrate surfaces are clean, dry, solid, straight, and free from drywall dust, bumps, projections, loose plaster, or paint.

C. Beginning of installation means acceptance of substrate.

3.2 INSTALLATION

A. Applying Panels: Follow the manufacturer's printed instructions for cutting and installing panels.
   1. Moldings can be applied by coated lath nails and/or adhesive. If nails only are used, backing materials must have nail holding capabilities or nails must be long enough to penetrate into furring or framing.
   2. All panel edges inside and outside corners are to finished with moldings appropriate to that purpose.
   3. All molding channels and joints between the system and different materials will be sealed with silicone sealant.
   4. Adhesive will be applied in strict accordance with the manufacturer's instructions and under conditions recommended as appropriate to the specific adhesive being used.
   5. Do not make panel joints directly over drywall joints.
   6. Do not fit panels too tightly in moldings. Allow at least ⅛" in all channels for panel expansion after installation is completed.

3.3 CLEANING

A. Clean panels with mild soap and water to remove excess adhesive/sealant at joints and on adjacent surfaces.

3.4 PROTECTION

A. Protect finished installation under provisions of Section 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

3.5 DEFECTS

A. Replace panels applied to defective substrate surfaces. Correct defects in completed installation.

END OF SECTION

SECTION 09 84 13

FIXED SOUND-ABSORPTIVE/SOUND-REFLECTIVE PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical wall and ceiling panels.

B. Related Requirements:
1. Section 0951 00 - Acoustic Ceilings.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Submit proposed layout of coverage by acoustical panels, details of proposed mounting method.

C. Samples:
1. Submit a minimum size of 12" x 12" sample of each proposed panel, to include specified facing, proposed edge detailing and a mounting element.
2. Submit manufacturer's available sample selections of fabric or color for Architect's selection and approval.

D. Certification: Submit manufacturer's certificates of flame spread rating of selected fabric facings or products, and independent laboratory tests of sound absorption coefficients for products in thickness specified.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Units shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

B. Acoustical Characteristics: Acoustical panels to perform as specified when tested in accordance with ASTM C423 and ASTM E90

2.2 ACCEPTABLE MANUFACTURERS

A. Acoustical Wall Panels: Provide acoustical wall panels as manufactured by one of the following:
1. Acoustical Surfaces, Inc
2. AVL Systems, Inc.
3. Kinetics Noise Control, Inc.
4. Conwed Designscape (Owens Corning)
5. QTS Quiet Technology Systems
6. Decoustics. Ltd (Saint-Gobain)
7. RPG Acoustics
8. Golterman & Sabo, Inc. (G&S Acoustics)
9. Wenger

2.3 ACOUSTIC WALL PANELS

A. Quality: Custom, fabric covered acoustical wall panels constructed of rigid fiberglass insulation core with fabric stretched and bonded over core. Panels shall have fully tailored square edges and corners, with fabric wrapped around edge and secured to back of panel. Edges shall be made rigid and abuse resistant by either chemical edge-hardening resin or non-ferrous metal framing.

B. Acoustical Wall Panels:
   1. Panel Core: 6 to 7 pound per cubic foot fiberglass or mineral wool insulation board; or molded rigid fiberglass honeycomb panels with flat fiberglass faces.
   2. Panel Fabric: As indicated on Material Finish Schedule.
   3. Panel Thickness: As required provide sound absorption specified.
   4. Panel Size: As Indicated.
   5. Sound Absorption (ASTM C 423): Noise Reduction Coefficient (NRC) minimum value 0.85 for a Type A mounting.

2.4 ACOUSTIC CEILING PANELS

A. Rigid Foam Deck Panels:
   1. Basis of Design Product: Sound Silencer acoustic ceiling panels by Acoustical Surfaces, Inc
   2. Panel Composition: Semi-rigid porous expanded polypropylene acoustical bead foam.
   3. Panel Thickness: 2” thick
   4. Panel Size: 2’x4’
   5. Edge Profile: Square
   6. Finish: As selected by Architect
   7. Mounting Method: Adhesive
   8. Sound Absorption (ASTM C 423): Noise Reduction Coefficient (NRC) minimum value 0.85 for a Type A mounting.

2.5 ACCESSORIES

A. Hardware: Manufacturer's standard concealed mounting hardware.

B. Adhesive: As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls for conditions that would prevent proper installation of acoustical products, and report such conditions to the Architect for correction.

B. Do not proceed until defective conditions are corrected.

3.2 INSTALLATION

A. Securely install acoustical panels aligned plumb and square, with uniform, tight butt joints between adjacent panels, in accordance with manufacturer's written directions.

B. Contractor shall remove packing material, construction debris, tools and equipment from site upon completion of work, leaving each installation clean and acceptable for use and occupancy by Owner.

END OF SECTION

SECTION 09 91 00

PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: On-the-job painting and finishing of exterior and interior surfaces.
   1. Included: Paint and finish the following materials, fittings, and equipment items which are exposed-to-view.
      a. Iron, steel, and galvanized metal.
      b. Wood.
      c. Concrete masonry units.
      d. Interior caulked joints.
      e. Bare and insulation covered piping and ductwork, conduit, hangers, grilles and registers, and primed metal surfaces and factory-finished surfaces of mechanical and electrical equipment.
   2. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels, including the following:
      a. Factory-finished metal lockers and finished light fixtures.
      b. Architectural aluminum and stainless steel.
      c. Interior concrete floors and steps and all exterior concrete.
      d. Acoustic panel ceilings, unless noted on drawings.
      e. Pre-finished cabinets.
      f. Operating parts: Moving parts of operating mechanical and electrical equipment, such as: valve and damper operators, linkages, sensing devices, motor and fan shafts
      g. Labels: UL, FM, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
   3. Contractor shall examine the drawings for mechanical and electrical work, and all materials installed throughout the building which require painting shall be painted under this section of the specifications.

B. Related Sections:
   1. Section 05 50 00 - Metal Fabrications: shop priming of metal fabrications.

1.2 SYSTEM DESCRIPTION

A. For purposes of this painting specification, the following areas and spaces are not considered finished, occupied areas and there will be no painting therein except for doors and frames and as may be specifically scheduled in article paint schedule.
   1. Mechanical chases.
   2. Spaces above suspended ceilings**.**

1.3 SUBMITTALS

A. Samples:
   1. Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
   2. Submit two 8-1/2" x 11" samples of each paint color scheduled on the color schedule prepared by the Architect. Samples shall be on heavy cardboard and shall be made with the actual mixed paints to be used on the project.
   3. Samples for Initial Selection of each type of texture finish product.

B. Paint Schedule: If painting materials other than those specified are proposed for use, submit a complete schedule of the materials to be substituted. This schedule, in triplicate, shall be in the same form as the paint schedule included in this section, and shall list materials by manufacturer, brand name, and type for each surface to be finished.

C. Close-out Schedule: Upon completion of work, furnish a full schedule of paint types and colors actually used and formulas for each to the Owner.

1.4 QUALITY ASSURANCE

A. Product Manufacturer: Company specializing in manufacturing quality paint and finish products with 3 years' experience.

B. Applicator: Company specializing in commercial painting and finishing with 2 years' experience.

C. Product Labels: Include manufacturer's name, type of paint, stock number, color and label analysis on label of containers.

D. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as final coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

E. V.O.C. (Volatile Organic Compound) Compliance: Products listed in the schedules and/or substitutes proposed for use by Contractor must be formulated to meet all applicable ordinances and regulations regarding maximum V.O.C. content. Utilize products which have been specially formulated to meet such requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials in original containers with seals unbroken and labels intact.

B. Storage: Contractor shall designate a specific space at the project site for storing and mixing materials. Protect this space and repair all damage resulting from use. Do not store kerosene nor gasoline in this space. Remove oily rags at the end of each day's work.

1.6 PROJECT CONDITIONS

A. Environmental Requirements: Maintain the temperature inside the building at not less than 60°F. during painting and finishing.

B. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 65°F. for 24 hours before, during, and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.

C. Minimum application temperatures for latex paints: 45°F. for interiors; 50°F. for exterior; unless required otherwise by manufacturer's instructions.

D. Minimum application temperature for varnish and finishes: 65°F. for interior or exterior, unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft.-candles measured mid-height at substrate surface.

F. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer's printed instructions. Painting may be continued during inclement weather only if the areas and surfaces to be painted are enclosed and heated within the temperature limits specified during application and drying periods of 24 hours between coats and 72 hours after final coat.

G. Protection: Provide sufficient drop cloths to fully protect adjacent finished work.

1.7 PRECAUTIONS

A. Do not store paints, oils, thinners and other flammable items inside the building. They shall be stored in approved containers when not in actual use during the painting job. The fire hazard shall be kept at a minimum.

B. Take precautions to protect the public and construction workers during the progress of the work.

C. Furnish a temporary fire extinguisher of suitable chemicals and capacity, located near flammable materials.

1.8 MAINTENANCE

A. Extra Materials: Upon completion of the work, deliver to project site 2 gallons of each type and color of paint applied to interior and exterior surfaces. Provide formula for custom match colors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide paint as manufactured by one of the following:
Benjamin Moore Paint Co. (http://www.benjaminmoore.com)
The Sherwin-Williams Co. (http://www.sherwin.com/default.asp)

B. Materials described are based on the specifications of the above listed manufacturers and are given to designate the quality of materials required. Materials of best quality grade are representative of the standard of quality required. Materials not displaying manufacturer's identification as a first line, best-grade product will not be acceptable.

C. Colors: The Architect will prepare a color schedule. Regardless of which brand of paint is selected for use the Contractor shall intermix and blend as required to obtain an exact match to each color on the color schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report to Architect any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
1. Concrete: 12 percent.
2. Masonry: 12 percent.

D. Test shop-applied primers for compatibility with subsequent cover materials.

E. Perform the following Test procedure prior to painting. This will determine if Passivators exist on galvanized metal. This procedure is not necessary on galvanized metal with G 90 Paint Grip.
1. Prepare a solution by dissolving 20 grams of copper sulfate in one liter (1000 grams) of water. Copper sulfate crystals may be purchased at most drug stores.
2. Solvent wash a small area per the procedure of SSPC-SP1.
3. Sand a small washed area using emery cloth.
4. Using a cotton swab saturated with the copper sulfate solution, apply a swipe to both sanded and unsanded washed areas.
5. If the sanded and unsanded surfaces turn black at the same time and that time is less than 10 seconds, there is no passivation on the surface other than light oil, and a normal degreasing/cleaning operation is sufficient preparation prior to the coating application. If the unsanded surface turns slower than the sanded surface, or not at all, a passivator of some type is present on the surface. If neither surface turns, the surface is probably an alloy of zinc or some other metal.
6. If the galvanized steel has been treated or passivated, the treatment or passivator must be removed by brush blasting. If this method is prohibited by environmental regulations, then chemical etching with Amchem's GALVAPREP SG-3 will be acceptable, if previously approved by the Architect. The chemical etching manufacturer’s procedures should be followed carefully.
7. If the surface is determined to be an alloy by this test procedure, notify Architect and adhesion tests of the proposed coating applied over the proposed surface preparation must be conducted.
8. If no passivators are present, wash galvanized metal surfaces with mineral spirits to remove residual grease and oil.

F. Beginning of installation means acceptance of existing surfaces and substrate.

3.2 PREPARATION

A. Perform preparation and cleaning procedures in accordance with coating manufacturer's instructions for each substrate condition.

B. Fill open joints, cracks and crevices on steel buck frames with metal putty and sand smooth before painting.

C. Remove hardware and accessories, plates, lighting fixtures and similar items which are not to be finish-painted or provide adequate surface-applied protection for these items in place.

D. Uncoated steel and iron surfaces: Remove grease, scale, dirt, and rust. Where heavy coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

E. Shop primed steel surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.

3.3 APPLICATION

A. Workmanship shall be of the highest quality. Mix and use paint materials in accord with the manufacturer's directions. Spread materials evenly, flow smoothly, and brush out without sags or runs.

B. Provide finish coats which are compatible with primer paints used. Provide barrier coats over incompatible primers where required.

C. When undercoats, stains or other conditions show through final paint coat, apply additional coats until paint film is of uniform color and sheen.

D. Finish the insides of wood cabinets as scheduled for the fronts and ends.

E. Between coats, sand enamel and lacquer finish on wood and metal surfaces to produce a smooth, even finish. Use #220 grit sandpaper or finer.

F. Tint priming coats and undercoats to approximate shade of final coat to assure uniformity of color in the finish. Touch up suction spots and "hot spots" before applying the last coat to produce an even result in the finish coat.

G. Exposed ductwork, piping and conduit in finished, occupied areas shall be painted the same color as the wall or ceiling against which it is installed, unless otherwise noted.

H. On concrete masonry unit wall surfaces without a block filler, apply the first coat of paint with a spray gun.

3.4 TOUCH UP AND CLEAN

A. Touching Up: On completion, carefully touch up all holidays, marred and damaged spots, and work over all surfaces that have been repaired by other trades.

B. Cleaning: Remove spilled, splashed, and splattered paint from all surfaces. Do not mar surface finish of item being cleaned.

C. Reinstall the items removed under the provisions of paragraph above.

3.5 PAINT SCHEDULE

A. Interior Metal
1. Steel door frames and louvers in doors, hollow metal doors, and ladders (Ferrous non-galvanized).
    1 primer coat
        SW DTM Bonding Primer (Raw Steel) B66A50
    2 finish coats
        SW Pro Industrial DTM Alkyd Gloss Coating B66-200 Series
2. Grilles, diffusers and registers in walls and ceilings.
    1 finish coat
        SW Pro Industrial DTM Alkyd Eg-shell Coating
3. Other exposed iron and steel.
    1 primer coat
        SW DTM Bonding Primer (Raw Steel) B66A50
    1 finish coat
        SW Pro Industrial DTM Alkyd Eg-shell Coating

4. Metal pipe, conduit, ductwork, hangers, supports and brackets.
   - 1 primer coat
     - SW Galvite Paint, B50 WZ30
   - 1 finish coat
     - SW ProMar 200 Alkyd Eg-Shel Enamel, Series B33 W 200
5. Other exposed galvanized metal.
   - 1 primer coat
     - SW Galvite HS
   - 2 finish coat
     - SW DTM Acrylic Gloss Coating
6. Items of mechanical and electrical machinery and equipment.
   - 1 finish coat
     - SW Industrial Enamel, Series B54

B. Interior Concrete Masonry
1. Concrete masonry unit walls scheduled to have Epoxy Paint.
   - 1 filler coat
     - SW Heavy Duty Block Filler, B42 W 46
   - 2 finish coats
     - SW Pro Industrial Water Based Catalyzed Epoxy 2-Part Paint Series B73 Series
2. Other concrete masonry unit walls.
   - 1 filler coat
     - SW Heavy Duty Block Filler, B42 W 46
   - 2 finish coats
     - SW Pro Industrial, Zero-VOC semi-gloss acrylic, B31 Series

C. Gypsum Wallboard
1. Gypsum board ceilings and furr downs.
   - 1 texture coat
     - USG Multi-Purpose Texture - Sprayed Splatter - Light Finish Texture
     - PPG Speedhide Acrylic Texture Coating 4-50
   - 1 primer coat
     - SW Hi-Build Primer - Latex Zero-VOC 200 B28W2600
   - 2 finish coats
     - SW ProMar 200 Latex Zero-VOC , Eg-Shel
2. Gypsum board walls.
   - 1 texture coat
     - USG Multi-Purpose Texture - sprayed splatter medium-light finish texture
     - PPG Speedhide Acrylic Texture Coating 4-50
   - 1 primer coat
     - SW Hi-Build Primer - Latex Zero-VOC 200 B28W2600
   - 2 finish coats
     - SW ProMar 200 Latex Eg-Shel, B32-2200 Series

D. Interior Caulked Joints
1. Caulking
   - 2 finish coats
     - SW Pro-Mar 200 Latex Semi-Gloss, B31 W 200

E. Exterior Metal
1. Steel door frames and hollow metal doors.
   - 1 primer coat
     - SW DTM Bonding Primer
   - 2 finish coats
     - SW DTM Acrylic Gloss Coating B66W1051
2. Steel pipe, conduit, hangers supports and brackets.
   - 1 primer coat
     - SW Galvite Paint, B50 WZ30
   - 1 finish coat
     - SW Industrial Enamel, Series B54

3. Galvanized steel pipe handrails, railings, lintels, ductwork, flashings, roof hatches, galvanized gutters and downspouts, scuppers, ventilators, and louvers. (Reference test procedure for Passivators)
    1 primer coat
        SW Pro Industrial Pro-Cryl Acrylic Primer
    2 finish coats
        SW DTM Acrylic Gloss Coating

END OF SECTION

SECTION 09 97 00

SPECIAL COATINGS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

A. The work includes the application of special coating systems to surfaces as scheduled, including surface preparation, prime coats, and topcoats.

B. Special coating systems are defined as those types of materials and methods of application requiring more than normal skills and techniques for mixing, handling, and application, as specified in SECTION 09 91 00 - PAINTING.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include copies of manufacturer's application instructions for special coating system.

1.3 DELIVERY AND HANDLING

A. Deliver materials to the project site in manufacturer's original, new and unopened packages and containers bearing manufacturer's name and label and the following information:
   Name or title of material.
   Manufacturer's stock number and date of manufacturer.
   Manufacturer's name.
   Contents by volume, for major pigment and vehicle constituents.
   Thinning instructions.
   Application instructions.
   Color name and number.
   Handling instructions and precautions.

B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45°F. in a well ventilated area. Maintain containers used in storage of coatings in a clean condition, free of foreign materials and residue.

1.4 PROJECT CONDITIONS

A. Apply coatings only when the temperature of surfaces to be coated and surrounding air temperature are above 45°F.

B. Do not apply special coating in snow, rain, fog, or mist; or when the relative humidity exceeds 85%; or to damp or wet surfaces; unless otherwise permitted by the coating manufacturer's printed instructions. Allow wet surfaces to dry thoroughly and attain the temperature and conditions specified before proceeding with or continuing with the coating operation. Work may be continued during inclement weather only if the areas and surfaces to be coated are enclosed and heated within the temperature limits specified by the coating manufacturer during application and drying periods of 24 hours between coats and 72 hours after final coat.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Floor Coating as manufactured by Tnemec. Refer to Schedule.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. General: Clean surfaces to be coated before applying coatings or surface treatments. Schedule cleaning and coating application so that dust and other contaminates will not fall on wet, newly coated surfaces.

B. Surface Preparation: Perform surface preparation and cleaning in compliance with the manufacturer's instructions for the particular substrate conditions, and as herein specified.

C. Cementitious Surfaces: Prepare cementitious surfaces of concrete scheduled to receive special coating by removing efflorescence, chalk, sealers, dust, dirt, grease, oils and by roughing to remove glaze. Use brush-off blast or acid etch cleaning methods as recommended by the coating system manufacturer.

D. Ferrous/Non-Ferrous Metal Surfaces: Clean galvanized and ferrous metal surfaces, remove oil, grease, dirt, mill scale, white rust and other foreign substances. Use power tool mechanical cleaning methods that comply with the recommendations of the Steel Structures Painting Council, SSPC SP-3.

3.2 MATERIALS PREPARATION

A. Carefully mix and prepare materials in accordance with coating manufacturer's instructions.

B. Stir materials before application to produce a mixture of uniform density and stir as required during the application. Do not stir surface film into the material. Remove the film and, if necessary, strain the coating material before using.

3.3 APPLICATION

A. Apply special coating in accordance with the manufacturer's directions. Use applicators and techniques best suited for the type of coating material being applied.

B. Minimum Coating Thickness: Apply each material at not thinner than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire coating system as recommended by the manufacturer.

C. Prime Coat: Before the application of finish coat, apply a prime coat, as recommended by the coating manufacturer.

3.4 CLEANING

A. Clean-Up: At the end of each work day during progress of work, remove rubbish, empty cans, rags and other discarded materials from the site. Upon completion of the work, clean window glass and other spattered surfaces. Remove spattered coatings by washing, scraping or other proper methods, using care not to scratch or otherwise damage adjacent finished surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether to be coated or not, against damage by coating operations. Correct damage by cleaning, repairing or replacing, and re-coating as acceptable to the Architect. Leave the work in an undamaged condition.

B. Provide "Wet Paint" signs as required to protect newly-coated finishes.

3.6 SPECIAL COATING SCHEDULE

A. Concrete floors

1st coat	Series 205 Terra-Tread FC at 3.0 to 5.0 mils DFT (Broadcast 30- 50 Mesh Silica)
2nd coat	Series 205 Terra-Tread FC at 3.0 to 5.0 mils DFT
3rd coat	Series 291 - Color CRU at 2.0 to 3.0 mils DFT

B. Galvanized/Ferrous metal cover plate, Grates and frames

1 primer coat	27 FC Typoxy
1 intermediate coat	S67 Skid-Resistant (Series 66 w/Broadcast 50 Mesh Silica)
1 finish coat	73 Endura-Shield

END OF SECTION

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SECTION 10 11 16

MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Framed markerboards and tackboards.

B. Related Requirements:
   1. Section 06 10 00 - Rough Carpentry; wood grounds.

1.2 SYSTEM DESCRIPTION

A. Performance Requirements:
   1. Reflectivity: Not to exceed specified range when tested at 60 degrees with a gloss meter in accordance with ASTM C 523.
   2. Contrast for marker boards (Light and Dark Effects): not more than 11.7 when tested with a BYK-Gardner Wave Scan 5+ Measurement Device showing visual acuity to the human eye at distances greater than 10 feet.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

B. Product Data: Include complete manufacturer's catalog cuts and data sheets of anchors, fasteners, color chips (photographic reproductions are not acceptable) and installation requirements.

C. Shop Drawings:
   1. Include types of units provided, location within each room, and length of each unit.
   2. Include dimensioned elevation drawings of each board assembly indicating joint locations and type of joint where required, and board mounting distances from floors.
   3. Include cross-section details showing each type of product and components; trim, face, core, backing materials and thickness, and key to elevations.
   4. Show anchorage details.
   5. Show installation details.

D. Samples: Submit a 12" x 12" sample of each type of markerboard and tackboard. Submit a 6" long sample of each component of exposed trim.

E. Quality Control Submittals:
   1. Test Reports: Copies of test reports, from certified testing agency, verifying that products have been tested and meet the specified performance requirements.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

B. Maintenance Data: Include data on regular cleaning, and stain removal.

1.5 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame/smoke rating for vinyl fabric covered tackboards in accordance with ASTM E 84.

B. BYK-Gardner Wavescan 5+

C. Porcelain Enamel Institute (PEI): PEI-1002, Manual and Performance Specifications for Porcelain Enamel Writing Surfaces (Whiteboards).

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on shop drawings.

1.8 WARRANTY

A. Assembled Units: Manufacturer's standard 1-year warranty against defects in materials and workmanship.

B. Special Warranty for Porcelain-enamel Face Sheets: Manufacturer's standard Life-of-the-building warranty in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship. Failures include, but are not limited to: 1) Surface lose original writing and erasing qualities; 2) Surfaces become slick or shiny; 3) Surfaces exhibit crazing, cracking, or flaking.

PART 2 - PRODUCTS

2.1 MATERIALS

A. (MB) Liquid Chalk Type Board: Provide projectable porcelain enamel steel liquid chalk writing system, 4'-0" height by length indicated. Product/ manufacturer; one of the following:
   LCS^3 White Board; Claridge Products and Equipment, Inc.
   Porcelain on Steel Markerboards; Platinum Visual Systems™; a division of abc School Equipment
   1. Face sheet of 24 gage leveled enameling steel with porcelain enamel writing surface.
   2. Core material of nominal 1/2" thick fiberboard or double-ply hardboard.
   3. Panel backing of 0.015" sheet aluminum or 26 gage sheet steel.
   4. Manufacturer shall factory assemble and bond together the face sheet, core and backing sheet.
   5. Colors shall be as selected by Architect.
   6. Markerboard panel shall be up to 16'-0" in length without joints.
   7. Provide music staffed boards where indicated.
      a. Staffing shall be fused 1/8" lines, 1" center to center, 5 spaces between staffs, both G and F clefs.
      b. Colors as selected by Architect.

B. Marker Wall (MW): Provide porcelain enamel steel liquid chalk writing system, 6'-0" high by length indicated. Product/ manufacturer; one of the following:
   LCSII White Board, #75 Low Gloss for projection; Claridge Products and Equipment, Inc.
   Egan Visual, Inc.
   Porcelain on Steel Markerboards, low gloss for projection; Platinum Visual Systems™; a division of abc School Equipment
   1. Face sheet of 24 gage leveled enameling steel with low gloss porcelain enamel writing surface.
   2. Core material of nominal 1/2" thick fiberboard or double-ply hardboard.
   3. Panel backing of 0.015" sheet aluminum or 26 gage sheet steel.
   4. Manufacturer shall factory assemble and bond together the face sheet, core and backing sheet.
   5. Joints shall be joined with steel spline for smooth alignment.
   6. No map rail.
   7. Provide magnetic marker tray model 264M1, Satin anodize finish. Aluminum tray is 2-3/4" deep.

C. Frames and Trim at Marker Wall (MW): Provide Koroseal steel mounting clip with 1-3/4" extruded clear anodized aluminum snap-on frames and trim at all edges.
   1. Install the steel clips 1/16" outside the markings on the wall. The clips should be installed every 16" on center, making solid contact with the wall stud, with the #10 X 1-1/2" screws. If the clip screws do not contact the studs, as with some of the vertically mounted pieces, use plastic wall anchors. The angled side of the clips, i.e. the flat beveled side, should always be mounted toward the ceiling on horizontal runs, while the rounded edge faces the floor. For vertical runs, the angled side faces the material being framed.
   2. Install the trim pieces to the clips. Place the aluminum trim over the angled side of the steel clips. Hold the face of the tray at a 45° angle from the wall. Hook the trim piece over the beveled edges of the clips and apply pressure with the heal of the hand to the side not locked in; trim will snap into the locked position. Repeat the same steps with all pieces of trim."

D. Framed Tackboard (TB): Provide vinyl covered tackboards in configuration as shown Product/ manufacturer; one of the following:
   Fabricork Vinyl Bulletin Boards; Claridge Products and Equipment, Inc.
   Vinyl Corkboard; Platinum Visual Systems™; a division of abc School Equipment
   1. Heavy-duty, self-healing vinyl machine laminated under high pressure to 1/4" thick cork.
   2. Rigid backing panel of 1/4" hardboard.
   3. Cork and backing panel shall be factory assembled and bonded together.
   4. Colors shall be as selected by Architect.
   5. Tackboards shall be up to 16'-0" in lengths without joints.

E. Frames and Trim: Provide not less than 1-1/2” wide, .062-inch thick, extruded aluminum frames and trim. Finish for exposed trim surfaces shall be Architectural Class II AA-M21A31 clear anodized coating (0.4 to 0.7 mil). Snap-on type trim is not acceptable. Product/manufacturer; one of the following:
   Series 1; Claridge Products and Equipment, Inc.
   HTS; Platinum Visual Systems™; a division of abc School Equipment

F. Map Rails: 1" wide of extruded aluminum with cork insert and Claridge No. 51ES type end stops. Furnish one No. 51M metal map hook for each linear foot of map rail and two No. 51FH flag holders for each room with map rails. Finish map rail to match the markerboard frames.

G. Chalktroughs: Heavy tubular type of extruded aluminum with cast aluminum end caps, finished to match the markerboard frames.

H. Adhesive: Flash-proof type furnished or recommended by the manufacturer.

2.2 FABRICATION

A. Fabricating Boards: Markerboards and tackboards shall be factory framed units up to 16'-0" one piece in length. Boards too large to be factory framed shall be assembled on the job to match the factory-built boards.
   1. Assemble frames with hairline joints. Corner joints shall be mitered. There shall be no exposed face fasteners of any sort.
   2. Make up boards in single sheets without joints where possible. Where vertical joints are necessary, space them symmetrically and use joint strips to cover them. Horizontal joints are not acceptable.
   3. Vertical joints between markerboard and tackboard in the same frame shall be covered with single mullion trim pieces. Double mullions at these joints will not be acceptable.
   4. Provide a map rail across the top of each markerboard unit.
   5. Provide a chalktrough under each markerboard unit.
   6. Manufacturer's labels shall not be exposed to view.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Verify surfaces to receive units are true and plumb. Report unsuitable conditions to the responsible contractor for correction prior to installation.
   2. Verify moisture and temperature levels of substrate and environment have stabilized.

3.2 INSTALLATION

A. Erecting Framed Units: Install framed markerboards and tackboards in conformance with the manufacturer's instructions using continuous wall hangers and adjustable mounting clip angles.
   1. On masonry walls, secure the hangers with screws into metal expansion shields or with toggle bolts.
   2. On gypsum wallboard partitions, locate the hangers to engage the steel stud flanges where possible and secure with molly bolts or self-drilling fasteners into the studs, or attach to wood blocking with suitable length screws.
   3. On back of markerboards, field install blocking pads at 16" on centers horizontally and vertically. Apply manufacturer's recommended adhesive evenly over entire surface of each pad using a serrated trowel.
   4. Behind the tackboards furnish and field install suitable blocking pads 16" o.c. each way to prevent bowing.
   5. Behind pegboards, field install blocking pads at 16" on centers.
   6. The installed boards shall be flat, plumb, square and rigid.
   7. Mounting Height: From finished floor to bottom of chalkrail or bottom of tackboard shall be: 36”

3.3 CLEANING

A. Remove crates, cartons and rubbish from the premises and leave the rooms broom clean. Clean down board surfaces to leave them in perfect condition.

END OF SECTION

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SECTION 10 12 00

DISPLAY CASES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Display cases.

B. Related Sections:
1. Division 26 - Electrical; rough-in for light fixture.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for display cases.
2. Include furnished specialties and accessories.
3. Include installation instructions.

C. Shop Drawings:
1. Include plans, elevations, sections, and attachment details.
2. Show location of seams and joints in tackboard panels.
3. Include sections of typical trim members.
4. Include diagrams for wiring of illuminated display cases.

D. Samples: Submit a 12" square sample of tackboard material and a 12" length of trim.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide 390 Series display cases as manufactured by Claridge, Inc. Equivalent products of one of the following will be acceptable:
A-1 Visual Systems
Nelson-Harkins Industries
Poblocki Sign Company
1. Provide in size(s) as shown on drawings.
2. Field verify opening for display cases.
3. Provide manufacturer’s optional fully recessed LED light fixtures. Control display case lights with side wall mounted switch.

2.2 MATERIALS

A. Aluminum Extrusions: Provide manufacturer's standard extruded aluminum sections of alloy and temper recommended by the aluminum producer or finisher for the type of use and finish indicated, and with not less than the strength and durability properties specified in ASTM B 221 for 6063-T5 alloy.

B. Glass: Provide clear, tempered safety glass complying with the requirements of ASTM C 1048, Type I, Kind FT, Condition A, Class 1 - transparent.

C. Tackboard: Provide seamless sheet, 1/4" thick ground natural cork compressed with a resinous binder with washable vinyl finish and integral color throughout, laminated to burlap backing. Provide color and texture as selected by Architect.

D. Fasteners: Provide screws, bolts, and other exposed fastening devices of the same material as the items being fastened. Use theft-proof fasteners.

E. Glazed Sliding Doors: 3/16" thick tempered glass, framed, with extruded aluminum frame; supported on ball-bearing rollers.
   1. Lock: Furnish each cover with the manufacturer's standard lock; key all locks alike. Furnish 2 keys per lock.

2.3 FABRICATION

A. General: Fabricate display cases to comply with dimensions, design, and details, and quality indicated.

B. Fabricate perimeter and cover frames with reinforced corners, mitered to a hairline fit, with no exposed fasteners.

C. Hardware for Covers: Equip covers with the manufacturer's standard hardware of the type indicated.

D. Provide the manufacturer's standard recessed display cases, fabricated to sizes indicated, consisting of the display case housing with perimeter frame, sides and back, tackable surface, and operable transparent covers with hardware.

E. Perimeter Frame and Cover Design: Provide extruded aluminum perimeter frame of profile indicated. Provide extruded aluminum door frame of the profile indicated, glazed with 3/16" thick clear tempered glass.

F. Finish: Class II, Clear Anodic Finish, AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units plumb, and level, in locations shown. Securely attach to the supporting structure with concealed fasteners, in accordance with the manufacturer's installation instructions.

3.2 CLEANING AND PROTECTION

A. Upon completion of installation, clean surfaces in accordance with the manufacturer's instructions. Protect units from damage until acceptance by the Architect.

END OF SECTION

SECTION 10 14 00

IDENTIFYING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast aluminum letters.
2. Interior room identification signs.
3. Exterior room identification signs.
4. Exterior room identification graphics.
5. Building dedication plaque.
6. Post and panel site signs.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Samples: Submit manufacturer's complete line of color samples, 1" x 3", for initial color selection.

C. Invoices: Submit certified copies of invoices indicating description and quantity of signs delivered and installed.

D. Template: Submit full-size template drawing for approval of aluminum letter size, stock, spacing, anchorage devices, etc.

1.3 PRE-INSTALLATION CONFERENCE

A. Pre-installation Meeting: Contractor shall schedule a pre-installation meeting at the project site with the Architect, Contractor and building letter installer for approval of template field layout prior to beginning of installation.

1.4 QUALITY ASSURANCE

A. Interior signs shall be provided by a single source with at least five years' experience successfully providing signs of similar type and scope.

B. Signs shall comply with the Texas Accessibility Standards (TAS) and other laws and ordinances of authorities having jurisdiction. Braille shall be Grade II, having dimensions as required to meet TAS.

1.5 PACKING, DELIVERY, AND STORAGE

A. Deliver components correctly packaged to prevent damage. Pack modules and back-up plates unassembled to allow for mechanical mounting of backplate to wall with concealed fasteners.

B. Individually and clearly identify each sign number, type, location to be installed, mounting instructions, and other pertinent information.

PART 2 - PRODUCTS

2.1 CAST ALUMINUM LETTERS

A. Basis of Design: A.R.K. Ramos Mfg Signage Systems.

B. Type: Custom fabricated letters and numbers as indicated on the drawings. Letters to be cast aluminum with baked enamel finish in custom color as selected by Architect.
1. Letters to read as referenced on drawings.

C. Material: Manufacturer's standard aluminum alloy for casting. Screws shall be stainless steel.

D. Fabrication: Letters shall be fully fabricated before enameling.
   1. Letters shall be cast with smooth flat faces, sharp corners, true lines and accurate profiles.
   2. Cast letters shall be free of pits, scale, and holes, or other defects and faces shall be mechanically finished to a satin texture and etched.
   3. Provide at least two points of attachment for each letter.

E. Pre-cleaning: Immerse the letters in hot alkaline cleaner to remove all contamination.

F. Finishing: Letters shall receive a baked-on enamel finish bonderized to aluminum at 350°F. and guaranteed for 5 years against peeling, fading, crazing and blistering.

2.2 INTERIOR IDENTIFICATION GRAPHICS

A. "InTouch" photopolymer plaque signs as manufactured by ASI Sign Systems, Inc. (8181 Jetstar Drive, Suite 100, Irving, Texas, 75063) or approved equivalent.
   1. Manufacture face panels utilizing an 1/8" integral photopolymer panel.
   2. Face panel tactile and Grade 2 Braille graphics shall be raised a minimum of 1/32".
   3. Treat the face panel to assure paint adhesion.
   4. Colors to be selected by Architect to meet ADA requirements for contrast.
   5. Characters and background of signs shall have eggshell, non-glare finish.
   6. Sign edges shall be painted to match background.
   7. Sign edges are to be smooth and free of saw marks and imperfections.
   8. Sign design shall be as indicated on drawings.
   9. Typeface shall be Helvetica Medium.
   10. Lettering shall be computer generated, accurately reproducing the letterform.
   11. Provide matching coverplate for signs mounted on glass.

2.3 EXTERIOR ROOM IDENTIFICATION GRAPHICS

A. Wall-mounted plaque signs as manufactured by South Texas Graphics or approved equivalent.
   1. Manufacture panels utilizing an aluminum panel.
   2. Face panel tactile and Grade 2 Braille graphics shall be raised a minimum of 1/32".
   3. Colors to be selected by Architect to meet ADA requirements for contrast.
   4. Sign edges are to be smooth and free of imperfections.
   5. Sign design shall be as indicated on drawings.
   6. Typeface shall be Helvetica Medium.
   7. Lettering shall be computer generated, accurately reproducing the letterform.

2.4 EXTERIOR ACRYLIC LOGO

1. Provide and install a ¼" thick acrylic logo as indicated on the drawings.
2. Mounting: As recommended by manufacturer
3. Color Selection by Architect

2.5 BUILDING DEDICATION PLAQUE

A. Provide building dedication plaque as manufactured by A.R.K. Ramos Manufacturing Co., Inc. or approved equivalent.

B. Material: Stainless steel with raised letters and graphics**.**
   1. Size: 24" width x 26" height x 3/4" thickness.
   2. Typeface: Futura Book and Bold, upper and lower case.
   3. Text: 500 letters in 18 - 20 lines with graphics as indicated, as provided by Architect.
   4. Finish: Mirror buff finish of face and edges with raised copy and graphics.
   5. Mounting: Provide 23-1/2" x 25-1/2" x 1/4" thick Lexan plastic mounting plate.
      a. Secure mounting plate to wall using toggle bolts.
      b. Attach plaque to a mounting plate using four matching dowels and construction adhesive.

2.6 POST AND PANEL SIGN

A. Basis of Design: Provide "Compass" Exterior Post and Panel Sign System as manufactured by ASI Sign Systems, Inc. Equivalent signs by the following manufacturers will be acceptable:
   APCO Architectural Signs
   ASI Sign Systems

Tablet & Ticket Co.

1. Post and panel signs as shown on drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Erecting Letters: Erect letters straight and level on the exterior face of building where shown.
   1. Attached to face brick: Secure with threaded stud anchors set in non-staining, quick setting cement. Letters shall be flush mounted to masonry surfaces.
   2. Attached to CMU wall: Secure letters to CMU wall with stainless steel threaded rods and non-staining, quick setting cement. Letters shall be flush mounted to masonry surfaces.
   3. Bottom rail mounting on top of prefabricated aluminum canopy or gate entrances when shown on drawings.
      a. Attach continuous aluminum rail to top of aluminum canopy as indicated on the Drawings.
      b. Drill and tap letters from the bottom, with stainless steel screws going through aluminum rails.
      c. Provide a flattened base on letters with round bottoms (O, S, G, etc.) to receive studs.
      d. Include tiebacks as recommended by letter fabricator.

B. Identification Graphics:
   1. On hard surfaces (i.e. ceramic tile, masonry, or plastic laminate), install room identification signs plumb and square with the "Tuff-bond" silicone adhesive furnished by the manufacturer (foam tape is not allowed).
   2. Tactile characters on signs shall be located 48 inches minimum above the finish floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
   3. Unless noted otherwise, install signs on latch side of the door such that clear floor space of 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
   4. Installation shall comply with ADA requirements.

3.2 CLEANING

A. On completion, clean exposed surfaces and leave free of defects.

B. Do not use abrasives.

3.3 COORDINATION

A. Contractor shall coordinate the installation of the identifying devices with other trades involved in the project.

3.4 DAMAGE

A. An identifying device which is scratched or defaced will be rejected.

END OF SECTION

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SECTION 10 21 13.19

PLASTIC TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Plastic toilet compartments and urinal screens.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry: wood blocking for bracket attachments.
2. Section 10 28 00 - Toilet Accessories.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:
1. Submit complete manufacturer's catalog cuts and data sheets with installation requirements supplied. Include finish and installation requirements for hardware, anchors, and fasteners.
2. Submit literature documenting that the compartment door latch meets Texas Accessibility Standards (TAS) requirements.

C. Shop Drawings: Include drawings for fabrication and erection of toilet compartment assemblies which are not fully described in manufacturer's data.

D. Samples: Submit a sample, 6" x 6", of each plastic finish and color selected. (photographic reproductions of color are not acceptable)

1.3 WARRANTY

A. Submit manufacturer’s standard 15-year warranty against breakage, delamination, and corrosion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide floor-mounted, overhead-braced toilet compartments. Product/manufacturer; one of the following:
Standard HDPE; Scranton Products (Santana/Comtec Ind./Capitol Partitions)
Polly™ HDPE; Metpar Corp.

B. Urinal Screens; product/manufacturer; one of the following;
Wall and Floor Mounted Urinal Screens; Scranton Products (Santana/Comtec Ind./Capitol Partitions)
Type FT Wall & Floor Mounted; Metpar Corp.

2.2 MATERIALS

A. Fabricate panels, doors, pilasters, and urinal screens from High Density Polyethylene (HDPE), not less than 1 inch thick, manufactured under high pressure to form a solid homogeneous sheet with a textured gloss finish. Color(s) shall be as selected by Architect.
1. Provide panels and doors with aluminum heat sink fastened to bottom edge with vandal-proof stainless steel fasteners.

B. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel of one-piece construction, 3" high, finish to match hardware.

C. Headrails: Extruded, polished anodized aluminum in anti-grip profile**.**

2.3 FABRICATION

A. Fabricate compartments with all edges machined to a radius of 0.250" with all sharp corners removed. Machine for hardware at the factory. Seal all plastic surfaces with protective film.

B. Fabricate flush compartment panels, pilasters and doors to the layout indicated with the following minimum dimensions.
   1. Where grab bars are indicated, provide a min. 32" wide (clear opening) out-swinging door.
   2. At other locations, standard compartments shall have a 24" wide in-swinging door unless specifically detailed and dimensioned otherwise.
   3. Doors and compartments panels 55" in length with a 14" clearance between floor and bottom of panels and doors. Pilasters shall be floor mounted, overhead braced, 82" high**.**
   4. Urinal screens 18" by 42" high.

C. Hardware: Provide hardware and fittings for compartment system of chrome-plated cast non-ferrous metal alloy, chrome-plated brass, or polished stainless steel. Stirrup brackets only may be heat-treated extruded aluminum with bright anodized finish.
   1. Hinges: Hinges: Full length extruded aluminum in bright dip anodized finish or 14 gauge stainless steel continuous piano hinge. Hinges shall be fastened with stainless steel screws.
   2. Latches: Heavy-duty extruded aluminum (6463-T5 alloy) and provision for emergency access and paddle handle on accessible stalls in compliance with the ADA. Latch housing shall have bright dip anodized finish.
   3. Strikes and Keepers: Wrap-around type with rubber bumper, mounted with through bolts.
   4. Coat hooks with rubber bumpers for in-swinging doors.
   5. Pulls: Provide pulls adjacent to the latch on both sides of the toilet partition door. Furnish with wall bumpers where required to prevent doors from striking wall.
   6. Brackets: Heavy duty aluminum (6463-T5 alloy) full length continuous wall brackets.
   7. Fasteners: Vandal proof (one-way) screws and sex bolts of chrome-plated brass or stainless steel for all exposed locations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check areas scheduled to receive compartments for correct dimensions, plumbness of walls, soundness of wall surfaces, location of built-in framing/anchorages/bracing, and other conditions that would affect proper installation of holding brackets and anchorage or suspension devices.

B. Verify spacing of plumbing fixtures to assure compatibility with installation of compartments.

3.2 INSTALLATION

A. Install compartments rigid, straight, plumb and with horizontal lines level. Drilling, cutting, and fitting to room finish shall be concealed in the finished work. Clearance at vertical edges of doors shall be uniform from top to bottom, and doors shall be free of warp and wind. Provide clearances of not more than ½" between pilasters and panels, and not more than 1" between panels and walls.
   1. Attach dividing compartments to the back wall with continuous wall brackets and at the front to the pilasters with the same type brackets. The use of U-type brackets is not acceptable**.**
   2. Attach overhead braces to walls with heavy saddle-type brackets.
   3. Attach pilasters to floor with ⅜" threaded studs, washers, lock nuts, expansion shields (minimum of 2" penetration into concrete) and pilaster brackets. Level, plumb and tighten the installation with the leveling device. Conceal the floor anchorage and bases with pilaster shoe assembly having concealed snap-down action on a concealed hold-down clip. Exposed fasteners on shoe will not be permitted.
   4. Provide a 13-1/2" clearance between floor and bottom of compartment panels and doors.
   5. Attach urinal screens to the wall with 3 heavy two-eared stirrup brackets. The use of U-type brackets is not acceptable.

3.4 ADJUST AND CLEAN

A. Adjusting: Adjust hardware just prior to final acceptance. Doors shall operate freely.
   1. For out-swinging doors, adjust hinges to hold doors closed.
   2. For in-swinging doors, adjust hinges to hold doors open at 30°.

B. Cleaning: Remove protective masking and clean surfaces, leaving them free of soil and imperfections.

END OF SECTION

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SECTION 10 28 00

TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Toilet accessories.

B. Related Sections:
1. Section 08 80 00 - Glazing: un-framed mirrors.
2. Section 10 21 13.16 - Plastic Laminate Toilet Compartments.

1.2 SUBMITTALS

A. Product Data:
1. Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
3. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

1.3 QUALITY ASSURANCE

A. Products: Provide products of the same manufacturer for each type of accessory unit and for units exposed in the same area.
1. Stamped names or labels on exposed faces of units will not be permitted.
2. Provide locks where specified, with the same keying for all accessory units in the project.

1.4 COORDINATION

A. Accessibility Standards: Coordinate accessory locations with other work to prevent interference with clearances required for access under Texas Accessibility Standards (TAS), Architectural Barriers Act--Article 9102, Vernon's Texas Civil Statutes and Texas Government Code, Chapter 469.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toilet accessories shall be of the quality manufactured by Bobrick Washroom Equipment, Inc. and are listed by Bobrick catalog numbers for convenience in identification. The use of a catalog number as a description of an item shall be taken to include the description or specification for the item in the manufacturer's catalog.

B. Toilet Accessories: Equivalent items of the following manufacturers are acceptable:
American Specialties, Inc.
Bradley Corp.
General Accessory Manufacturing Co. (GAMCO)
McKinney/Parker Washroom Accessories Corp.

2.2 BASIC MATERIALS

A. Stainless Steel: ASTM A 666, Type 304 with No. 4 satin finish.

B. Brass: ASTM B 19, leaded and unleaded flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; ASTM B 30 castings.

C. Sheet Steel: ASTM A 1008, cold rolled, commercial quality.

D. Galvanized Steel Sheet: ASTM A 653, G60 (Z180).

E. Chromium Plating: ASTM B 456, Service Condition Number SC 2 (moderate service), nickel plus chromium electro-deposited on base metal.

F. Mirror Glass: ASTM C 1036, Type I, Class 1, Quality q3, nominal 1/4" thick, with silvering, electroplated copper coating, and protective organic coating complying with ASTM C 1036.

G. Galvanized Steel Mounting Devices: ASTM A 153, hot-dip galvanized after fabrication.

H. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

I. Keys: Provide universal keys for access to accessories for servicing and resupplying. Provide minimum of six keys.

2.3 ACCESSORIES

A. Grab Bars (B1, B2): Model B-6806, lengths as shown on drawings; Model B-6861 at showers.

B. Mirrors (C1): Model B-290 2436.

C. Mirror, Unframed (D): Reference SECTION 08 80 00 - GLAZING.

D. Sanitary Napkin Disposal Units (F1): Model B-270.

E. Mop & Broom Holder/Custodian's Utility Shelves (J1): Model B-224 x 36", one per Custodian's Closet and where scheduled.

F. Coat/Robe Hooks (K1): Model B-211.

G. Shower Curtain Rod, Curtain and Hooks (L1):
   1. Shower Curtain Rod: Model B-6107
   2. Shower Curtains: Model 204
      a. Provide correct widths of shower curtain for 36" openings and for 37" to 60" openings.
      b. Length of curtain shall be 72” at non-accessible shower compartment with curb.
      c. Length of curtain at accessible shower compartment without curb shall be 78”, installed with bottom of curtain 1” above threshold.
   3. Shower Curtain Hooks: Model 204-1

H. Shower Seat, Folding, L-Shaped (M1): Model B-5181.

I. Baby Changing Station (P1): Model KB110-SSRE baby changing station by Koala Kare Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers’ written instructions and recommendations, using fasteners appropriate to substrate and recommended by manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated. Adhesive mountings and plastic rawl plug mounts will not be acceptable.

B. Secure mirrors to walls in concealed, tamper-resistant manner with special hangers, toggle bolts, or screws. Set units level, plumb, and square.

C. At toilets with wheelchair compartments all toilet accessories shall be installed so that operating areas such as coin slots, pushbuttons, openings for towels, cups and waste are not more than 48" above finished floor for frontal approach.

D. Attach dispensers and cabinets to steel stud partitions with suitable hollow wall screw anchors. Attach dispensers and cabinets to masonry partitions with stainless steel expansion shields and machine screws.

E. Attach sanitary napkin disposal units and toilet tissue dispensers to toilet partition panels with stainless steel or chrome plated through bolts and hex cap nuts.

F. Install grab bars to withstand a downward load of at least 250 lbf. Attach grab bars to toilet partition panels with stainless steel through bolts and plated hex cap nuts. Attach grab bars to steel stud partitions with connector assemblies to steel anchors fastened to studs. Attach grab bars to masonry partitions with stainless steel expansion shields and machine screws.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION

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SECTION 10 44 13

FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fire extinguishers and fire extinguisher cabinets.

1.2 DEFINITIONS

A. Where indicated on the drawings the abbreviation "F.E.C." defines a fire extinguisher and cabinet and the abbreviation "F.E." is for fire extinguisher without cabinet.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include physical dimensions, operational features, color and finish, anchorage details, material descriptions and type of hardware.

C. Shop Drawings: Include rough-in measurements, locations, and details for cabinets.

1.4 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

B. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain products in this Section from one manufacturer.

B. Certifications
1. Provide extinguishers which are U.L. listed and bear the U.L. "Listing Work" for type, rating, and classification.
2. Conform to NFPA-10 requirements for extinguishers.
3. Provide units conforming with ANSI/UL 711.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

B. Store extinguishers in protected location until after final cleaning is completed.

1.7 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Do not store products subject to freeze damage in environments where damage could occur.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Provide multi-purpose dry chemical type fire extinguisher, 10 lbs. nominal capacity. Provide manufacturer's standard hook type bracket where fire extinguishers are noted without cabinets. Product/manufacturer; one of the following:
   Cosmic 10E; J.L. Industries, Div. of Activar, Inc.
   MP10; Larsen's Manufacturing Co.
   Wing 10HB; Modern Metal Products
   Model 3010; Potter-Roemer

2.2 FIRE EXTINGUISHER CABINETS

A. Provide stainless steel trim and door. Doors shall be solid with vertical window and have continuous piano hinge. “Fire Extinguisher” vertical ascending silk-screened lettering in red. Product / manufacturer; one of the following:
   Fire-FX 1037V10 Cosmopolitan; J.L. Industries, Div. of Activar, Inc.
   FS SS2409-R4 Vertical Duo, Acrylic; Larsen’s Manufacturing Co.
   “Alta” Series No. 7063-DV-6; Potter-Roemer.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer’s standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for type and capacity of fire extinguisher indicated, with plated or baked-enamel finish. Color shall be red.

B. Identification: Identify bracket-mounted fire extinguishers with the words “FIRE EXTINGUISHER” in red letter decals applied to mounting surface. Orientation shall be horizontal.

2.4 FABRICATION

A. Form body of cabinet with tight inside corners and seams.

B. Predrill holes for anchorage.

C. Form perimeter trim and door stiles by welding, filling, and grinding smooth.

D. Hinge doors for 180° opening with continuous piano hinge. Provide nylon roller type catch.

2.5 FINISHES

A. Extinguisher: Red enamel.

B. Cabinet Trim and Door: Stainless steel.

C. Cabinet Interior: White enamel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fire extinguisher cabinets at locations indicated in accordance with the manufacturer's instructions. Install level, plumb, secure. Install fire extinguisher cabinets with operable part of extinguisher at 48" above finished floor.

B. Install fire extinguishers within cabinets on mounting brackets, placed in such a manner that operating instructions face outward.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb. Apply identification decals above bracket-mounted fire extinguishers.

D. Service, charge (if required), and tag each fire extinguisher not more than five calendar days prior to substantial completion.

END OF SECTION

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SECTION 10 51 13

METAL LOCKERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal lockers.

B. Related Sections:
1. Section 03 30 00 - Cast-in-Place Concrete; concrete in base.
2. Section 04 20 00 - Unit Masonry; Concrete masonry unit bases.
3. Section 06 10 00 - Rough Carpentry; wood sleepers and wood blocking.
4. Section 09 65 00 - Resilient Flooring; rubber base.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Submit complete manufacturer's catalog cuts and data sheets of hardware, anchors, fasteners and installation requirements.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. Show base, sloping tops, filler panels, and other accessories. Include locker identification system.

D. Samples: Submit color chips (photographic reproductions of color are not acceptable).

1.3 QUALITY ASSURANCE

A. Uniformity: Provide each type of metal locker as produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

B. Store and protect lockers under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

C. Protect locker finishes and adjacent surfaces from damage during installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. General Lockers: Materials and methods described are based on the specifications of Penco Products**,** Inc. (www.pencoproducts.com) and are given to designate the quality of materials and workmanship required. Equivalent lockers as manufactured by one of the following will be acceptable:
Art Metal Products, Div Fort Knox Storage Co. (www.artmetalproducts.com)
List Industries, Inc. (www.listindustries.com)
Lyon Metal Products, Inc. (www.lyonmetal.com)

B. Athletic Lockers: Materials and methods described are based on the specifications of List Industries, Inc. (www.listindustries.com) and are given to designate the quality of materials and workmanship required. Equivalent lockers as manufactured by one of the following will be acceptable:
DeBourgh (www.all-american-lockers.com)
Lyon Metal Products, Inc. (www.lyonmetal.com)
Penco (www.pencoproducts.com)

2.2 STANDARD LOCKERS

A. Materials: Sheet metal shall be smooth cold-rolled steel, ASTM A 1008, at least 16 gage for doors and frames and 24 gage for bodies. Nuts and bolts shall be cadmium plated.

B. Construction: Doors shall be louvered at top and bottom, and adequately flanged at edges. Door frames of channel shapes shall be securely welded together. Provide continuous door strikes at jambs. Provide rubber silencers on each latching hook. Fabricate to swing 180°.
   1. Ventilation: Provide stamped, louvered vents in door face, as follows:
      a. Single-tier Lockers: Not less than 6 louver openings top and bottom.
   2. Hinges: Heavy-duty, not less than 0.050" thick steel, full-loop, 5 knuckle, tight pin, 2" high. Provide at least 3 hinges for each door over 42" high and at least 2 hinges for each door 42" high or less.
   3. Provide mounting feet and base cover for Type A lockers.

C. Locks:
   1. Recessed handle with:
      a. Built-in combination with push-button combination change and master key control; Masterlock Series 1630/1631 - automatic locking.
   2. Provide handicapped accessible latches on accessible lockers.

D. Trim: 16 gage steel filler strips to cover spaces between lockers and adjacent walls at ends of rows and elsewhere as may be required. Provide finished end panels (no holes) for exposed ends of locker rows. Finish trim to match lockers.

E. Equipment: Furnish each locker with the following items.
   1. Double-tier Lockers:
      a. One double prong hook and not less than two single-prong wall hooks.
      b. At handicapped accessible lockers, hat shelf, hooks and handle with locker or hasp must be no higher than 48” from finish floor
      c. At handicapped accessible lockers, locker bottom must be a minimum of 15" from finish floor. If locker bottom is lower than 15” from finish floor, provide internal shelf at a minimum of 15” above finish floor.

F. Continuous Sloping Tops: Not less than 18-gage sheet steel, approximately 25° pitch, in lengths as long as possible. Provide closures at ends. Finish to match exterior of lockers.

G. Finish:
   1. Chemically pre-treat metal with degreasing and phosphatizing process.
   2. Enamel powder coat paint finish electrostatically applied, baked, and properly cured to manufacturer’s specifications for optimum performance.
   3. Finishes containing volatile organic compounds and subject to out-gassing are not acceptable.
   4. Color: Lockers shall be one custom color exterior and shall be manufacturer's standard color interior. Colors as scheduled in Material Finish Key on drawings.

H. Number Plates: Aluminum with black filled numbers, fastened with rivets to the top of the front face of the locker door, not in the recess. Number lockers consecutively as directed by Owner.

2.3 ATHLETIC LOCKERS

A. Provide all welded construction athletic lockers. Nuts, bolts, screws, and pop-rivets will not be allowed.
   1. Doors: 14 ga. diamond perforated, 1" double bends on both sides and single ⅞" bend at top and bottom. Latch hooks shall be located directly across from hinges.
   2. Vertical dividers: ¾" 13 ga. flattened expanded metal framed by 16 ga. hollow "T" sections designed to conceal sharp edges of divider with entire assembly mig welded. Dividers shall have channel bracing at the bottom forming a rigid frame for each locker unit.
   3. Solid backs shall be 18 ga. cold rolled sheet steel.
   4. Provide double-tier and multi-tier lockers as indicated.
   5. Provide concrete base mounting for all athletic lockers. Provide 4” tall base at Type F lockers. Refer to drawings for concrete bench as base for lockers for Types A1, B, C, D, and E).

B. Locks:
   1. Recessed handle with:
      a. Built-in combination with push-button combination change and master key control; Masterlock Series 1654/1655 - automatic locking at Types A1, B, C, D, E.
      b. Provisions for Owner-furnished padlocks at Type F.
   2. Provide handicapped accessible latches on accessible lockers.

C. Trim: 16 gage steel filler strips to cover spaces between lockers and adjacent walls at ends of rows and elsewhere as may be required. Provide finished end panels for exposed ends of locker rows. Finish shall match lockers.

D. Equipment: Furnish each locker with the following items.
   1. Single-tier Lockers:
      a. Hat shelf, one double-prong hook, and not less than two single-prong wall hooks.
      b. At handicapped accessible lockers, locker bottom must be a minimum of 15" from finish floor. If locker bottom is lower than 15” from finish floor, provide internal shelf at a minimum of 15” above finish floor.
      c. At handicapped accessible lockers, hat shelf, hooks and handle with locker or hasp must be no higher than 48” from finish floor.
   2. Double-tier Lockers:
      a. One double prong hook and not less than two single-prong wall hooks.
      b. At handicapped accessible lockers, hat shelf, hooks and handle with locker or hasp must be no higher than 48” from finish floor
      c. At handicapped accessible lockers, locker bottom must be a minimum of 15" from finish floor. If locker bottom is lower than 15” from finish floor, provide internal shelf at a minimum of 15” above finish floor.
   3. Triple-tier Locker:
      a. One double-prong hook, and not less than two single-prong wall hooks.
      b. At handicapped accessible lockers, locker bottom must be a minimum of 15" from finish floor. If locker bottom is lower than 15” from finish floor, provide internal shelf at a minimum of 15” above finish floor.
      c. At handicapped accessible lockers, hooks and handle with locker or hasp must be no higher than 48” from finish floor.
   4. Six-tier Pass-through Front/Rear Entry Lockers:
      a. Side-hinged doors.
      b. Lockable door on front of each locker with one tamper-proof latch door on back to cover each set of six stacked lockers.
      c. Corresponding rear number plates.
   5. Provide Hanging Rod and Lock box at Varsity and Athletic Coach Lockers

E. Continuous Sloping Tops: Not less than 16-gage sheet steel, approximately 25° pitch, in lengths as long as possible. Provide closures at ends. Finish to match exterior of lockers.

F. Finish:
   1. Chemically pre-treat metal with degreasing and phosphatizing process.
   2. Enamel powder coat paint finish electrostatically applied, baked, and properly cured to manufacturer’s specifications for optimum performance.
   3. Finishes containing volatile organic compounds and subject to out-gassing are not acceptable.
   4. Color: Lockers shall be one custom color exterior and shall be manufacturer's standard color interior. Colors as scheduled in Material Finish Key on drawings.

G. Number Plates: Aluminum with black filled numbers, fastened with rivets to the top of the front face of the locker, not in the recess. Number lockers consecutively as directed by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases and verify that bases are properly sized and located. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Verify locations, size, and height of benches to receive lockers.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.

B. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36" o.c. The use of sheet metal screws for assembly and installation is not allowed.

C. Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

3.3 ADJUST AND CLEAN

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint.

C. Touch-up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION

SECTION 10 56 13

METAL STORAGE SHELVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Metal storage shelving and pallet racking.

1.2 SUBMITTALS

A. General: Submit following items in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include complete manufacturer's catalog cuts and data sheets, complete parts list, installation requirements, and all pertinent performance characteristics and criteria.

C. Shop Drawings: Indicate materials, construction, sizes, quantities, finishes, and installation details.

1.3 QUALITY ASSURANCE

A. Source Limitations: Provide metal storage shelving of the same manufacturer throughout the project.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide metal storage shelving as manufactured by one of the following:
Lyon Workspace Products
Penco Products, Inc.
Republic Storage Systems Co.
Richards-Wilcox
Tennsco
Western Pacific Storage Systems

2.2 MATERIALS

A. Storage Shelving Basis of Design: Provide RiveTier Long Span Shelving as manufactured by Western Pacific Storage Systems (1-800-270-0427).
1. Size: 7'-0" H x 48" W x 24"D with a shelf capacity of 1000 lbs.
a. Metal Shelves: 22 gauge steel.
b. Standard Duty Angle Upright Post - LURH - 14 gauge steel.

B. Pallet Rack Basis of Design: Provide Pallet Racking with Wire Deck as manufactured by Lyon Storage Solutions (1-800-323-0082).
1. Size: 2 level 96” H x 108" W x 48"D, starters and add-ons as required for layout on drawings.

2.3 FABRICATION

A. Fabricate metal storage shelving and pallet racking square and rigid with posts plumb and true, and shelves flat and free of dents or distortion. Fabricate exposed metal edges free of sharp edges and burrs. Fabricate connections to form a rigid structure, free of buckling and warping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install metal storage shelving and pallet racking in strict accordance with manufacturer's written instructions and recommendations.

B. Install metal storage shelving level and pallet racking, plumb, square, and true.

C. Install bracing as recommended by manufacturer and as required for stability.

3.2 PROTECTION

A. Protect the completed work from damage. Replace damaged items which cannot be repaired. Protect finished installation in accordance with SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

3.3 CLEANING

A. Upon completion of the building, clean the metal storage shelving and pallet racking. Leave the metal storage shelving and pallet racking free of defects and in ready-to-use condition.

B. Perform final cleaning in accordance with SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

SECTION 10 73 26

PREFABRICATED WALKWAY COVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Prefabricated walkway canopies.

B. Related Requirements:
1. Section 03 30 00 - Cast-in-place Concrete.
2. Section 07 92 00 - Joint Sealants.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Include drawings showing small scale layouts of prefabricated walkway canopies and large-scale details of edge conditions, joints, expansion joints, anchorages, trim, closures, and special details.

C. Samples: Submit two 12" square samples of finished metal panels.

D. Certification: Submit design calculations sealed and signed by an engineer registered in the State of Texas. Design calculations shall state that the protective cover system design complies with the wind requirements of all governing jurisdictions, the stability criteria of applicable building code, and all other governing criteria.

1.3 QUALITY ASSURANCE

A. Wind Loading: Fabricate and install prefabricated walkway canopies and other components of system to comply with code requirements for resisting wind effects based on a 120 mph wind.

B. Installer Qualifications: Engage an experienced installer who is an authorized representative of the canopy manufacturer and has completed installation of canopies similar in material, design, and extent to canopy required for this project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide prefabricated walkway canopies as manufactured by one of the following:
AVAdek
Dittmer Architectural Aluminum
Mapes Industries, Inc.

2.2 MATERIALS

A. Aluminum Sheets: Extruded aluminum sections, Alloy 6063, T6 temper.

B. Structural Supports: Extruded aluminum sections, Alloy 6063, T6 temper.

C. Fasteners: Manufacturer's standard non-corrosive types, with heads gasketed.

D. Accessories: Provide components required for a complete prefabricated walkway canopy system, including fascia, trim, closures, clips, fillers, and similar items. Match materials and finishes of prefabricated walkway canopy framing.

E. Finish and color selection of each component shall be chosen from the manufacturer's color selections and shall include:
   1. Clear anodized finish (minimum thickness of 0.7 mils).
   2. Prefinished fluoropolymer coating containing 70% Kynar 500. Color shall be custom or standard color as selected by Architect from Fluropon colors as manufactured by Valspar.

2.3 FABRICATION

A. General: Fabricate and finish canopies and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and dimensional requirements. Internal gutters shall connect to weep system.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to receive prefabricated walkway canopies for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. General: Comply with canopy fabricator's and material manufacturer's instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor supports and other components of the work securely in place, with provisions for thermal and structural movement. Install expansion joints to provide for thermal and structural movement.

3.3 CLEANING AND PROTECTION

A. Damaged Units: Replace canopies and other components of the work which have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Cleaning: Upon completion of canopy installation, clean finished surfaces as recommended by canopy manufacturer, and maintain in a clean condition during construction.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Flagpoles and flags.

B. Related Sections:
1. Section 32 13 13 - Concrete Paving: concrete for flagpole base.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Submit product data for flags.

B. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include manufacturer's installation instructions.

1.3 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".

B. Basic Wind Speed: 120 mph; 3-second gust speed at 33 feet above ground.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide flagpoles as manufactured by one of the following:
American Flagpole; a Kearney-National Inc. Co.
Baartol Co., Inc.
Concord Industries, Inc.
Ewing International
Morgan-Francis Div.; Original Tractor Cab Co., Inc.

B. Provide flags as manufactured in the United States as supplied by United States Flag Store or supplied locally by In the Wind - Houston 713.469.6686.

2.2 FLAGPOLES

A. Pole: External halyard, cone tapered aluminum.
1. Material: Seamless alloy 6063-T6 aluminum tubing uniformly cone tapered.
2. Height: 35'-0" exposed.
3. Finish: Clear anodized.

B. Fittings: Furnish fittings equal to the following:
1. Anodized aluminum ball: Sized to match pole butt diameter.
2. External Halyard Ball-Bearing, Nonfouling, Revolving Truck assembly of cast metal with continuous braided polypropylene halyard and 9" cast-metal cleats with fasteners. Finish exposed metal surfaces to match flagpole.
3. Provide one halyard and one cleat.
4. Provide cast-metal cleat covers, finished to match flagpole, secured with cylinder locks.
5. Collar: Spun aluminum, same finish as flagpole, 14" diameter, 2-1/2" high.
6. Two-Flag Arrangement: Provide two beaded retaining loops (one at the bottom of each flag) and four swivel snaps per flagpole, of bronze with neoprene or nylon covers.

C. Foundation Tubes: Standard weight steel pipe having self-centering fins, centering bolts, and lightning ground spike. Hot-dip galvanize the assembly after fabrication.

2.3 FLAGS

A. United States Flag: American Flag 4ft x 6ft Valley Forge Koralex II 2-Ply Sewn Polyester as supplied by United States Flag Store (phone 877.734.2458 web site: www.united-states-flag.com). Flag shall be manufactured in the United States.

B. Texas Flag: Texas Flag 4ft x 6ft Sewn Polyester as supplied by United States Flag Store (phone 877.734.2458 web site: www.united-states-flag.com). Flag shall be manufactured in the United States.

PART 3 - EXECUTION

3.1 PREPARATION

A. Paint portions of pole below grade with heavy coat of bituminous paint.

3.2 INSTALLATION

A. Set foundation tube accurately and hold in position until concrete is placed.

B. Install flagpole and fittings in accord with shop drawings and manufacturer's instructions.

C. Reeve the halyard through the truck sheave and connect the free ends together as recommended by the pole manufacturer to form a closed loop halyard.

D. Deliver United States flag and Texas flag to the Owner at project site.

3.3 ADJUSTING

A. Adjust fittings for smooth operation of halyard.

END OF SECTION

SECTION 10 99 00

MISCELLANEOUS SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Knox Box.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry; blocking.
2. Section 06 20 00 - Finish Carpentry; mounting bases.
3. Section 09 51 00 - Acoustical Ceilings.
4. Division 26 - Electrical; connection to Security System.

1.2 SUBMITTALS

A. General: Submit following items in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include complete manufacturer's catalog cuts and data sheets, complete parts list, installation requirements, and all pertinent performance characteristics and criteria.

C. Shop Drawings: Indicate materials, construction, sizes, quantities, finishes, mounting attachments, and installation details.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the engineering and manufacturing of product, with not less than 5 years of experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Knox Box: Fire/Rapid Entry System at the gate and two at the building as manufactured by The Knox Company.
1. Model 3200 RTS with 3200 RMK Recessed Mounting Kit.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrate surfaces as recommended by manufacturer.

3.2 EXAMINATION

A. Verify that surfaces and conditions are ready to receive work of this Section.

B. Notify Architect of any existing conditions which will adversely affect execution.

C. Beginning of execution will constitute acceptance of existing conditions.

3.3 INSTALLATION

A. Television Wall Brackets: Install securely anchored to provide rigid installation. Television wall brackets shall be installed in strict accordance with manufacturer's instructions.

B. Knox Box:
   1. Recessed Mounting:
      a. The Mounting Kit may be set in place during construction of the masonry wall. Wiring conduit may be connected through one or several knock-out holes in the shell housing. Care should be taken to insure that the front of the shell housing, including the cover plate and screw heads, are flush with the finish wall. The shell housing should be plumbed with a level. Leave cover and screws in place until the KNOX-BOX unit is ready to be mounted inside. The five (5) mounting studs may be replaced with bolts or longer studs if required. Do not over tighten mounting nuts, as they may distort the outside flange. With the housing held firmly in place, drill two (2) ⅛" holes through the form wall and the housing front cover. Insert screws and pull housing tight against the form wall. Remove screws before removing form.
      b. Model 3200-RTS is shipped with a door tamper switch mounted in place. Before mounting, carefully remove the door tamper switch and set aside. This will give clear access to inside mounting holes. Do not allow the upper right-hand fastener to extend too far into the box so as to interfere with the door tamper switch. The alarm wiring to the tamper switch should be pulled tight so that any attempt to force box out of wall will break the wire or pull terminals loose. Push-On type terminals are supplied for connection to tamper switch. Tamper switch can be connected for either open or close circuits.

C. Vinyl Wall Graphics at Concrete Masonry: Vinyl Graphics shall be applied using a foam roller and heat gun per 3M recommendations.

3.4 ADJUSTING

A. Adjust and fit items to be flush with adjacent construction.

B. Fasten or adhere for tight connections and joints.

3.5 PROTECTION

A. Protect the completed work from damage.

B. Replace damaged items which cannot be repaired.

C. Protect finished installation in accordance with SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

3.6 CLEANING

A. Upon completion of the building, clean area. Leave products free of defects and in ready-to-use condition.

B. Perform final cleaning in accordance with SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

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SECTION 11 31 00

APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Appliances.

B. Related Sections:
1. Section 12 32 16 - Manufactured Plastic-laminate-clad Casework
2. Division 22 - Plumbing: plumbing rough-in.
3. Division 26 - Electrical: electrical rough-in.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

B. Product Data: Include list of optional features, operating characteristics, and dimensions of individual appliances.

C. Operating and Maintenance Manuals: Provide per SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.

D. Shop Drawings: Submit rough-in drawings showing dimensioned locations of electrical and plumbing stub-outs for appliances.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements: Provide electrical components required as part of appliances that are listed and labeled by UL and that comply with applicable NEMA standards.

B. Accessibility Standards: Where appliances are required to comply with accessibility requirements, comply with Texas Accessibility Standards (TAS).

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Appliances shall be of the quality manufactured by Whirlpool Corp. and U-Line Corp. and are listed by Whirlpool and U-Line catalog numbers for convenience in identification. The use of a catalog number as a description of an item shall be taken to include the description or specification for the item in the manufacturer's catalog. Equivalent items of the following manufacturers are acceptable:
Hotpoint
GE Appliances
KitchenAid
Maytag

2.2 EQUIPMENT

A. Dishwasher: Provide Model No. GDT225SSLSS, stainless undercounter dishwasher as manufactured by GE Appliances. Stainless steel tall tub, Energy Star, delay wash, and 51dba. Height adjustable from 32-1/4" (ADA height) to 34-5/8" (Standard height). Dishwasher shall meet NSF/ANSI 184 requirement for reaching a final rinse temperature of 150ºF.

B. Countertop/Recessed Wall Microwave: Provide Model No. WMC30516H as manufactured by Whirlpool. Color as selected by Architect, 1.6 Cu.Ft., 1200 watts, sensor cooking, recessed glass turntable, including 30” trim kit.

C. Microwave/Hood Combination: Provide Model No. WMH75520A as manufactured by Whirlpool. Color as selected by Architect, recirculating fan for non-vented use, 2.0 Cu.Ft., sensor cooking, 1100 watts, 4-speed fan, 300 CFM, recessed glass turntable.

D. Refrigerator: Provide Model WRT138FZD as manufactured by Whirlpool. Color as selected by Architect, 18.24 Cu.Ft. (Refrigerator-13.14/Freezer-5.10), Energy Star, freezer-on-top, auto defrost, include optional automatic ice maker.

E. Undercounter Ice Maker: Provide Nugget ice Model No. CO-80AJ-AD as manufactured by Hoshizaki. Stainless steel.

F. Commercial Washer Extractor: Provide Model T-900, front-load, 60 lb, 9 cf, 3 hp motor, washer-extractor as manufactured by Dexter.
   1. Wash Speed: .9 RPM.
   2. Extractor Speed: 100 RPM high, 60 RPM intermediate.

G. Commercial Drying Tumbler: Provide Model T-80 Express Dryer 80 lb gas model, tumbler speed 40 RPM 60 Hz as manufactured by Dexter.

H. Clothes Washer: Provide Duet® Model No. WFW560CHW, White ONLY, HE front load, 4.3 cu. ft. capacity, Energy Star Qualified, ADA compliant, clothes washer as manufactured by Whirlpool.

I. Clothes Dryer: Provide Duet® Model No. WED560LHW, White ONLY, HE front load, 7.4 cu. ft. capacity, Energy Star Qualified, ADA Compliant, electric clothes dryer with wrinkle shield as manufactured by Whirlpool.

J. Whirlpools:
   1. Whirlpool: Provide Model S-110-S, 110v/120v, 110 gallon stationary whirlpool as manufactured by Whitehall Manufacturing.
   2. Whirlpool Table: Provide Model 7724 as manufactured by Bailey Manufacturing Company.

K. Treatment Tables:
   1. Treatment Table: Provide Model 1013-27 Classic Series 27” wide Treatment Table with drawers and with black Pad Cover as manufactured by Clinton Industries, Inc.
   2. Mat Platform: Provide Model 240-57 Upholstered Mat Platform, 7’Lx5’Wx18”H with black Pad Cover as manufactured by Clinton Industries, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for piping systems to verify actual locations of piping connections before appliance installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Comply with manufacturer's written instructions.

B. Built-in Appliances: Securely anchor units to supporting cabinets or countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.

C. Freestanding Appliances: Place units in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate appliances.

3.3 CLEANING AND PROTECTION

A. Test each item of appliances to verify proper operation. Make necessary adjustments. Verify that accessories required have been furnished and installed.

B. Remove packing material from appliances and leave units in clean condition, ready for operation.

C. Protection: Protect the completed work from damage.

END OF SECTION

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SECTION 11 40 00

FOODSERVICE EQUIPMENT

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 WORK

A. Include the work specified, shown or reasonably inferable as part of Foodservice Equipment.

1.3 RELATED WORK IN OTHER SECTIONS

A. Slab depressions, reinforced concrete wearing bed and interior finished floor at Walk In Refrigerator/Freezer.

B. Concrete or masonry platforms with coved base at perimeter, for equipment.

C. Slab depressions for stainless steel drain trench liner/grate assemblies.

D. Corner guards.

E. Supply and exhaust fans for foodservice exhaust/supply hoods.

F. Roughing in and final connection of mechanical, electrical, and plumbing except indirect wastes built in to fabricated equipment.

1.4 QUALITY ASSURANCE

A. In addition to complying with applicable laws, statues, building codes and regulations of public authorities, comply with the following:
   01 National Sanitation Foundation (to bear label)
   02 National Electric Code
   03 Underwriters' Laboratories, Inc.
   04 American Gas Association Laboratories
   05 National Fire Protection Association
   06 American Disabilities Act

1.5 SUBSTITUTIONS

A. Equipment items or components specified are intended to be the Basis of Bid. All other brands, including additional names listed as "Approved Equal" must conform with the specifications, size, accessories, etc. of the first- named brand and be subject to Paragraph C-03 of this Article.

B. Proposed Substitutions:
   01 Submitted no less than 14 calendar days prior to Bid Date.
   02 Submit with catalog data and/or manufacturer's shop details indicating all modifications required to conform with specified brand.

C. Substitutions with Prior Approval:

01 Submitted on Bidder's letterhead attached to Proposal Form with each additive/deductive amount stipulated.
02 Owner reserves the right to accept or reject any or all substitution proposals before execution of contract.
03 Provide all engineering services required to make adjustments in space, utilities, etc. and pay all additional costs of utilities or construction that may occur due to the requirements of the accepted substitutions.

1.7 WARRANTY

A. Provide a written warranty for a period of one year from the date of Substantial Completion, including extended four year replacement warranty on compressor bodies.

B. Components of equipment subject to replacement prior to one-year's use (such as steam cooker door gaskets) and those items which may fail due to improper or inadequate 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.

1.8 INSTRUCTIONS TO BIDDERS

A. During Bidding: Contractor's or vendor's questions and comments pertaining to document clarity or intent will be responded to with addendum.

1.9 SUBMITTAL DATA

A. Special Requirements: The following are in addition to any general requirements given elsewhere in the Documents.

B. Procedures: Submit to the consultant (through the Architect) for preliminary review, one (1) electronic copy and/or at least two (2) prints/hardcopies, within four weeks after award of contract. Upon return of one (1) copy of data, submit the required number of copies to the Architect for processing. Partial submittals will not be accepted or processed.

C. Brochure:
01 Front and rear covers with labeled project name.
02 A separate flysheet for each component or item of equipment, indicating: item number, name, quantity, manufacturer, optional equipment, modifications, and utility requirements. An item of equipment or assembly containing more than one buy out sub-assembly or component shall have the secondary item listed in parenthesis beside the primary item name, i.e, Dishtable (Disposer).
03 Catalog specification sheet and/or manufacturer's drawing.

D. Plan and Rough in Drawings:
01 1/4" scale drawing of fixed/non- fixed Foodservice Equipment with itemized schedules.
02 Separate drawing sheets of same size as contract drawings (Contract Drawings are not to be traced or reproduced).
03 Electrical roughing in drawing.
04 Plumbing/mechanical rough in drawing.
05 Critical dimension drawings, sizing and locating the following conditions:
a. Slab depressions or block outs.
b. Concrete or masonry platforms.
c. Pipe sleeves or roof jacks.

06 Required information:

a. All fixed and movable Foodservice Equipment shown on Contract Drawings.

b. All general use and convenience utilities or services indicated, including those required or connected to equipment or devices not in this Section.

c. All roughing in drawings fully dimensioned from finished room surface and/or established column lines to point of stub up through floor and stub out through wall or ceiling for all mechanical, electrical and plumbing services.

1.10 OPERATIONS & MAINTENANCE MANUAL

A. Three copies bound in 1-1/2" hardback, three ring binders (as many volumes as required by scope of project) with same data as brochure at completion of installation.

B. Catalog specification sheet and/or manufacturer's shop drawings.

C. Manufacturer's operating/maintenance data including replacement parts information and price list. Provide the name, title and address of personnel at each respective manufacturer to be contacted for spare of replacement parts after guarantee period.

D. Furnish a list of all equipment and their respective local service agencies, indicating the address, telephone number and name of person to contact. Whenever possible, the service agencies selected shall be factory authorized for the equipment assigned.

1.11 VERIFICATION AND COORDINATION OF PROJECT/DATA

A. Refrigerated and Dry Storage Areas: Verify and coordinate dimensions to accommodate modular shelf sections. Notify Architect of variance between the Contract Documents and actual conditions.

B. Rough-In Drawings: Review for accuracy and completeness and notify Architect of deficiencies. Field-check locations. Cooperate and coordinate work with other sub-contractors.

C. Dimension Responsibility: Obtain actual or guaranteed measurements for proper fit of equipment. All dimensions given are approximate and are as accurate as can be determined at this time. Field check all measurements and conditions at the building prior to fabrication or delivery of equipment and notify the Consultant of any deviation from the dimensions shown.

D. Scheduling to Fit Openings: Should it become necessary to schedule construction of walls or partitions prior to 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.

E. Existing Equipment: Foodservice Contractor is responsible for verifying mechanical, electrical and plumbing characteristic of any existing equipment scheduled for re-use prior to submitting rough-in drawings. Foodservice Contractor to perform all tasks required to integrate/complete any new items with existing equipment and field conditions.

PART 2 - PRODUCTS

2.1 PLUMBING/MECHANICAL REQUIREMENTS

A. Plumbing fittings and components: furnished under this Section as follows. Components which are provided loose under this Section for field installation and connection by Division 22 are indicated by asterisk* or as indicated on details.

01* Control valves, water pressure regulators, vacuum breakers and chrome plated 90º elbows and nipples (no copper piping above splash) wherever required on Foodservice Equipment.
02* Faucets and drain fittings with connected overflows for all sinks.
03* Specialty Foodservice water fill faucets or hose assemblies indicated in drawings/specifications.
04* Wade No. W-10 Shock Stop shock absorbers for all Foodservice Equipment with quick opening or solenoid operated water valves.
05 Extensions of indirect waste originating with-in fabricated counters and/or equipment to open site drains. Drains: 1" minimum, Type "K" copper. All material and labor for final connection from equipment/sink tail pieces and anklets to open-sight drain over building floor sink or drain by Division 22.
06 All drainlines furnished with equipment: 1" thick insulation.
07 Piping brackets and/or supports beneath/within fabricated equipment.

B. Final Plumbing Connections Provisions:
01 Fabricated equipment containing components, fittings and/or devices indicated on Foodservice Connections Drawings to be connected to the building systems shall have each component, fitting or group thereof prepiped to a utility compartment for final connection by Division 22. Refer to drawings for capacities.
01. Division 22 to supply all required piping/nipples, etc. to make complete installation. All gas lines connected to equipment with flexible hoses with quick connection action. (Quick-connects and steel reinforced supply hoses, by K.E.C.) Installed by Division 22.
02. Field assembled equipment (i.e., conveyor systems, exhaust hoods, conveyor type dishware machines, convection ovens, etc.) shall have plumbing components completely interconnected under this Section for final connection by Division 22 in arrangements indicated on Utility Connection Drawings by Division 22.
03. Back flow preventers, when required by local code, to be provided by Division 22.

C. Ducts and Vents:
01 Exhaust hoods, which are furred in to ceiling: 2" high duct collar for final connection to duct system.
02 Dishwash machine equipped with integral vent cowls or extended hoods: furnished with 18 gauge stainless steel seamless duct risers to 6" above finish ceiling for final connection. The duct: trimmed at ceiling with 16-gauge stainless steel angle flange with all corners welded.

2.2 ELECTRICAL REQUIREMENTS

A. Electrical fittings and components: furnished under this Section as follows. Components provided loose under this Section for field installation and connection under Division 26 are indicated with, by asterisk * or as indicated on detail. Coordinate foodservice equipment voltage and phase with building system.
01* Ceiling lights, pre-wired with pigtails and mounting hardware consisting of F.S. J/box with cover and G.I. or plastic nipple to fasten to walk-in box ceiling panels. K.E.C. to provide all lights and drill holes in walk-in boxes ceiling, Division 26 will install lights and loop wire to electrical roughing-in J/box above walk-in boxes door panel and seal all holes in panels. All wiring to be above ceiling panels in code acceptable conduits.
02 Division 26 to connect all control wiring for walk-in box evaporators from remote compressor panel to walk-in box evaporators and provide disconnect switch on evaporator, all wiring rigid metal conduit, to code requirements. K.E.C. to supply remote outdoor refrigeration racks, pre-wired to master control panel. Division 26 to connect power lines from roughing-in points to master control panel.

B. Cord and caps:
   01 Coordinate all Foodservice Equipment cord/caps with related receptacles.
   02 All 120 volts "plug in" equipment shall have Type SO or SJO cord and plug with ground wire fastened to frame/body of item.
   03 Cord lengths for fixed equipment: adjusted to eliminate loose-hanging excess.
   04 All non-fixed plug in "buy-out" equipment shall have Hubbell configuration, ratings as required.

C. Switches and Controls:
   01 Each motor driven appliance or electrically heated unit: equipped with control switch or starter as per Underwriters' Laboratories, Inc. with low voltage and overload protection.

D. Motors:
   01 120-volt motors; manual tumbler type starter with thermal overload protection and interchangeable heating elements.
   02 208 volt and 480 volt motors; magnetic starter with low voltage protection and one interchangeable overload relay per phase.

E. Receptacles and Switches:
   01 Receptacles installed in/on-fabricated equipment: Hubbell, Inc. assemblies mounted in a metal box with stainless steel cover plate.
   02 Load centers installed in/on fabricated equipment to have all fixture components pre-wired to load center with balanced phase loading. Load center ready for final connection by Division 26.

F. Final Electrical Connection Provisions:
   01 Fabricated equipment containing electrically operated components and/or fittings indicated on Utility Connections Drawings to be direct connected, shall have each component, fitting or group thereof pre-wired to a junction box for final connection by Division 26. Refer to drawings for circuit loading.
   02 Fabricated equipment containing electrically operated components and/or devices indicated to have a circuit breaker load center shall have each component or device pre-wired to a separate circuit breaker for balanced phase loading and single final connection by Division 26.
   03 Field assembled equipment (i.e., prefabricated walk in refrigerator/freezers, exhaust hoods), shall have electrical components completely interconnected in this Section for final connection arrangements as indicated on Utility Connection Drawing.

PART 3 - EXECUTION

3.1 DELIVERY AND INSTALLATION

A. Supervision: Provide a competent foreman or supervisor who shall remain on the job during the entire installation.

B. Delivery: Foodservice Equipment excluding exhaust hoods, trench liners and walk-in coolers/freezers are <u>not</u> to be delivered and/or set in place until the following construction has been completed: kitchen floors prepped and cleaned, walls painted, ceiling installed, and wiring pulled to junction boxes. (note 1. acid floor washes are not to be used on or near stainless or aluminum surfaces. 2. Walk-in doors are to remain open during concrete cure).
   01 Assemble, square, level and make ready items for the final utilities connections.
   02 Scribing: cut neatly around obstructions to provide sanitary conditions.

03 Where gaps occur between equipment, apply General Electric silicone construction sealant Series SE-1200 mastic or stainless steel trim molding of proper shape with concealed attachment. Use epoxy cement and/or "zee" clips wherever possible to secure trim.

3.2 CLEAN AND ADJUST

A. Clean up and remove from the job site, all debris resulting from the work as the installation progresses.

B. Thoroughly clean and polish all Foodservice Equipment, in and out, ready for Owner's use prior to demonstration and final inspection.

C. Lubricate and adjust drawer slides, hinges, casters.

D. Clean and replace faucet aerators, water strainers.

E. Touch up damage to painted finishes.

F. Start up and check all refrigeration systems for at least 72 hours prior to acceptance.

3.3 EQUIPMENT START-UP/DEMONSTRATION

A. Carefully test, adjust and regulate all equipment in accordance with 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 and/or Operators with a thorough operational demonstration of all equipment and furnish instructions for general and specific care and maintenance.

3.4 FINAL INSPECTION

A. Final inspection will be made when the contractor will certify that he has completed his work; made a thorough review of the installation/operation of each item in the contract and found it to be in compliance with the construction documents.

B. The Foodservice Consultant's repetitive final inspection and all costs associated thereto, incurred due to the Contractor's failure to comply with the requirements of this Article, will be invoiced to this Contractor.

4.0 EQUIPMENT SCHEDULE

A. Provide regularly manufactured equipment components included in this Section with standard finishes and accessories unless specifically deleted or superseded by the Contract Documents.

Item No. 01 – Dry Storage Shelving **Quantity One (1) Lot**

A. One (1) Lot InterMetro "Metro Max Q" shelving, five (5) tiers high, each section with four (4) MQ74P, posts. Sections as follows:
   01. Four (4) MQ2442G shelf section.
   02. Seven (7) MQ2448G shelf sections.

B. One (1) Lot InterMetro “Metro Max I” dunnage shelving. Sections as follows:

01. Two (2) Model No. MHP2448G, dunnage racks with MX13P posts. Provide Model No. M3TF2448E, three sided channel/truss frame for each unit.

Item No. 02 – Reach-In Freezer **Quantity One (1)**

A. One (1) True Model No. STR2F-2S-HC, reach-in freezer.

B. Door swing as indicated.

C. Three (3) additional shelves.

D. Mount on casters with brakes.

Item No. 03 – Reach-In Refrigerator **Quantity One (1)**

A. One (1) True Model No. STR2R-2S-HC, reach-in refrigerator.

B. Door swing as indicated.

C. Three (3) additional shelves.

D. Mount on casters with brakes.

Item No. 04 – Utensil Rack **Quantity One (1)**

A. One (1) New Age Model No. 96087, flat lid display freezers.
01. Mount on casters, with brakes.

Item No. 05 – Three-Compartment Sink **Quantity One (1)**

A. One (1) three compartment sink assembly; size and shape as indicated on drawings.

B. 1-1/2" rolled rim at front and ends; 10" high splash where adjacent to wall.

C. Three (3) 18” x 26” x 15” deep sink compartments.

D. Three (3) Component Hardware Model No. D53-7215, rotary drains with connected overflows and tailpiece.

E. Two (2) T & S Model No. B-0290, splash mount faucets. Provide with Model No. B-0230KIT, installation kit.

F. Open base construction.

G. Undershelf below drainboard.

H. One (1) wall mounted louvered overshelf, length as indicated.

Item No. 06 – Back Counter **Quantity One (1)**

A. One (1) back counter assembly; size and shape as indicated on drawings.

B. Turn edges down 2" square.

C. Closed base construction.

D. Bottom and intermediate shelves.

E. Stainless steel hinged doors, provide with stainless steel hinge and locks. Refer to Details for construction.

F. Mount counter on a 6" high adjustable stainless steel legs with removable stainless steel kickplate on all exposed sides.

G. One (1) Square D Model No. 120/208 volt, three phase, 4 wire, QO320L125G, load center with Model No. QOC24UF, cover and PK4GTA, ground bar kit with visi trip breaker. Load centers installed in/on fabricated equipment to have all fixture components pre-wired to load center with balanced phase loading.

H. Load center to be ready for final connection by Electrician and flush-mounted within utility compartment stainless steel rear panel, set back 8 inch from access door. All breaker/device information: typewritten on circuit schedule in load center door (number corresponding breaker/device) with enclosed schematic wiring diagram of fixture components.

I. Mount Component Hardware Model No. R58-1010 under counter to support countertop equipment.

Item No. 07 – Popcorn Machine **Quantity Two (2)**

A. Two (2) Gold Medal Model No. 2553, popcorn machine.

Item No. 08 – Food Warmer **Quantity Four (4)**

A. Four (4) Hatco Model No. HW-FUL, countertop warmers.
01. Dome lid.

Item No. 09 – Drink Cooler **Quantity One (1)**

A. By purveyor.

Item No. 10 – Number Not Used

Item No. 11 – Ice Machine/Bin **Quantity One (1)**

A. One (1) Hoshizaki Model No. F-450MAJ, ice machine mounted on a Model No. B-500SF, bin. Insulate drain lines with one inch (1") thick insulation.

B. One (1) Arctic Pure Model No. AR-10000, water filter for icemaker. Provide two (2) additional cartridges K-00338, for a total of three (3). Mount on wall adjacent to equipment.

C. Insulate drain lines with 1" thick insulation.

Item No. 12 – Worktable **Quantity One (1)**

A. One (1) worktable assembly; size and shape as indicated on drawings.

B. Turn free sides down 2" square; ¾" radius corners, 6" backsplash.

C. Extend through opening and turn down 2".

D. Open base construction.

E. Undershelves, size and shape as indicated on drawing.

E. Omit front crossrail to allow for Item No. 16 – Beverage Cooler.

F. Provide grommet holes for cord access for power and data cables.

Item No. 13 – Worktable **Quantity One (1)**

A. One (1) worktable assembly; size and shape as indicated on drawings.

B. Turn free sides down 2" square; ¾" radius corners, 6" backsplash.

C. Extend through opening and turn down 2".

D. Open base construction.

E. Undershelves, size and shape as indicated on drawing.

E. Omit front crossrail to allow for Item No. 16 – Beverage Cooler.

F. Provide grommet holes for cord access for power and data cables.

Item No. 14 – Drawer Warmer **Quantity One (1)**

A. One (1) Alto-Shaam Model No. 500-2D, two-drawer warmers.

Item No. 15 – Heated Display Case **Quantity Two (2)**

A. One (1) Hatco Model No. GR2SDH-36, countertop display warmers.

Item No. 16 – Bottle Cooler **Quantity Two (2)**

A. Two (2) Mod-U-Serve Model No. MCT-BC1-S, flat top beverage coolers.

Item No. 17 – Fly Fan **Quantity One (1)**

A. One (1) Mars Model No. HV248-1UD, fly fan.
01. Install micro switch in doorframe so unit operates when door is open.

B. Mount at receiving door as indicated.

Item No. 18 – Ice Machine **Quantity One (1)**

A. One (1) Hoshizaki Model No. F-300BAJ, flaker ice machine. Insulate drain lines with one inch (1") thick insulation.

B. One (1) Arctic Pure Model No. AR-10000, water filter for icemaker. Provide two (2) additional cartridges K-00338, for a total of three (3). Mount on wall adjacent to equipment.

C. Insulate drain lines with 1" thick insulation.

Item No. 19 – Ice Machine/Bin **Quantity One (1)**

A. One (1) Hoshizaki Model No. KM-520MAJ, ice machine mounted on a Model No. B-1150SS, bin. Insulate drain lines with one inch (1") thick insulation.

B. One (1) Arctic Pure Model No. AR-10000, water filter for icemaker. Provide two (2) additional cartridges K-00338, for a total of three (3). Mount on wall adjacent to equipment.

C. Insulate drain lines with 1" thick insulation.

END SECTION 11 40 00

SECTION 11 68 00

PLAY FIELD EQUIPMENT AND STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous items such as galvanized field corner markers, track finish line markers, goal posts, and scoreboards.

B. Related Sections:
1. Section 32 18 13 - Synthetic Grass Surfacing.
2. Section 32 18 14 - Paved Elastic Layer
3. Section 32 18 23.39 - Synthetic Running Track Surfacing.
4. Section 32 31 13 - Chain Link Fences

1.2 SUBMITTALS

A. Shop Drawings:
1. Submit shop drawings for each product in accordance with Section 01 33 23
2. Indicate details of fabrication, anchorage, and related construction. Indicate accessories and finishes.

B. Delegated Design: Submit structural calculations and shop drawings prepared by manufacturer for review by project engineer. Shop drawings and calculations shall be sealed by a professional engineer registered in the State of Texas. Engineer shall have a minimum of 5-years' experience with projects of similar scope.

1.3 WARRANTY

A. Provide 3-year warranty.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Goal Posts: Provide 20'-0" uprights with an 8'-0" offset, "slingshot" type high school goal posts of aluminum pipe per detail shown on Drawings. Color shall be powder coat of "Saturn Yellow." Provide two (2) goal posts (1 pair) at each field as manufactured by the following or approved equal:
Gill Athletics www.gillathletics.com
Gilman Gear www.gilmangear.com

B. Finish Line Markers: Finish line markers shall be 2" in diameter galvanized pipe sleeve, 24" long set in 12" diameter concrete footing, 30" deep.

C. Radius Point and Corner Markers: 1" diameter galvanized steel pipe as detailed, complete with 2" diameter rubber cover.

D. Corner Marker Pylons: Pylons shall be 4"x4"x18" foam covered with vinyl as manufactured by BSN Sports, (800) 527-7510, or approved equal.

E. Field Event Equipment: Field event equipment shall be as manufactured by Aluminum Athletic Equipment Co., (800) 523-5471, as listed below or approved equal.
1. Shot Put Toe Board - #ATBC.
2. Shot Put Ring - #SC.
3. Discus Ring - #DC.
4. Discus Cage and Nets - HSDC with offset Barrier Net BN-HSDC
5. Pole Vault Box and Cover - #SSVB.
6. Long Jump/Triple Jump Off Boards - HTB-8.

F. Soccer Goals: Provide Model No. SGR-P (one pair) of Square Steel Portable Soccer Goals as manufactured by Aluminum Athletic Equipment or Bison.
1. 24'-0" W x 8'-0" H x 4" diameter wall tube construction with 8'-10" Stays.

2. Color shall be powder coat White.
3. High visibility white, 3mm polyethylene braided into 5" sq. mesh nets.

G. Netting at ends of football (and practice) fields:
1. Provide Model # MBS-40 (40' high system, straight post) as manufactured by AAE (Aluminum Athletic Equipment Co.); 1000 Enterprise Drive, Royersford, PA 19468; Toll Free (800) 523-5471:
   a. Posts: Straight Post 8.625"O.D. x .188" wall x 45.80"lg., 40'-9" out of ground, 6061T6 aluminum extrusion with pre-drilled holes for mounting hardware, 8.625" O.D. x .148" wall x 78"lg. 6061T6 aluminum ground sleeve with a stop-bolt at 60". Typical spacing between posts 20' maximum.
   b. Net: 40' high, #AAE420, 1-1/2"sq. (45mm) black UV-treated HTTP knotted net, 360# tensile strength, ¼" MFP rope border all 4 sides, pre-attached sewn in 3/16"dia. galvanized clear coated cable.
   c. Hardware: All stainless steel, galvanized and brass hardware, pulley system for raising/lowering net, 5/16" braided rope with pre-attached hardware, a cleat for rope tie-off, an eyebolt at bottom of post to secure net.
   d. Footing Specification: 36" diameter x 84" depth, bell bottom of hole, 6" compacted crushed stone at bottom, 4,000lbs. mix concrete. Installation by contractor, consult local codes.

2.2 SCOREBOARDS

A. Structure for all Scoreboards shall be delegated design. Reference Submittals Article in Part 1 - General for more information.

B. Football Field Scoreboards:
1. Provide model 11232-C4 with MSX control scoring console Spectrum Corporation, 10048 Easthaven Blvd., Houston, TX 77075 Phone: 713-944-6200, 800-392-5050, Fax: 713-944-1290
   Website: spectrumscoreboards.com
   a. Provide the following displays.
      i. 99:59 Minute Clock/Timer
      ii. HOME and VISITOR score
      iii. DOWN
      iv. TO GO
      v. BALL ON
      vi. QUARTER
      vii. TOL (Time Outs Left)
      viii. Ball Possession indicators
      ix. Team Name in place of HOME (optional)
   b. Scoreboard:
      i. Dimensions: 10 feet high x 32 feet wide x 5 inches deep
      ii. (3.0 m x 9.8 m x 13 cm)
      iii. Weight: 700 lbs. (320 kg)
      iv. Power requirements: 840 VA, 120 VAC, 60 Hz
      v. Shall have a Premium Polyurethane Finish
      vi. Select from stock colors or match to a PMS color (number _____)
      vii. Shall have a deluxe game horn rated at 100 dB @ 10'0"
      viii. Shall have Border Trim and Clock Striping
      ix. Scoreboards functionality shall include:
         1. 99:59 Minutes/Seconds Clock counts up or down
         2. Segment Timer capable
         3. Track timing to 1/100 second
         4. Home score 0-99 with programmable Celebration "Flash" feature
         5. Visitor score 0-99
         6. Down 1-4
         7. To Go 0-99 rest to 10 yards
         8. Ball On 0-50 with instant clear
         9. Quarter 1-4
         10. Automatic Clock reset and quarter advance
         11. TOL (Time Outs Left) count from 3-0
         12. Ball Possession
         13. Instant reset and posting for all digits
   c. Construction:
      i. Scoreboard face: .063 aluminum with premium polyurethane finish
      ii. Scoreboard back: .050 mill finish aluminum
      iii. Digit face plate: .063 thick

d. Digits
   i. Shall be constructed of AlInGaP Light Emitting Diodes (LEDs)
   ii. Shall be a combination of red and amber LED digits
   iii. Shall be rated 100,000 hours of use
   iv. Shall be 8-segment solid stroke design
   v. All pixels shall be interchangeable throughout the scoreboard
   vi. All pixels shall be conformal coated front and back to protect the electronics from environmental conditions
   vii. All pixels shall be individually gasketed for weather protection
   viii. All pixels shall be individually serviceable from the front of the scoreboard cabinet
   ix. Scoreboard assembly shall include sixteen (16) numeric LED digits and two (2) ball Indicators.
   x. Digit sets shall have:
      1. Ultra-Bold Style LED digit technology
         30” (762 mm) high – Clock, Home and Visitor score
         Shall include 432 LEDs per digit
         24” (61 cm) high - Down, To Go, Quarter and Ball On
         21” (53 cm) high – TOL (Time Outs Left)
         Shall include 320 LEDs per digit

e. Captions:
   i. HOME and VISITOR shall be 18” high (46 cm)
   ii. DOWN, TO GO, QUARTER and BALL ON shall be 14” high (36 cm)
   iii. TOL shall be 10” high (25 cm)
   iv. Captions shall be 3M brand 220 High Performance Vinyl applied directly to scoreboard face

f. Control Scoring Console:
   i. Control shall be an MSX controller.
   ii. Controller functionality shall include:
      1. Easy set up for 15 different sports
      2. Changeable key pad inserts for other sports
      3. Memory backup to retain configurations and eliminate data loss
      4. Durable, lockable rugged waterproof carry case
      5. A ten (10) foot (3 m) low voltage data cable cord that connects to control receptacle junction box and shall unplug and store inside the carrying case
      6. Does NOT require hazardous 120 VAC electrical power
   iii. Easy Programming:
      1. Celebrate a home score with flashing numbers
      2. Option to use as a Practice Segment Timer or Time of Day Clock
      3. Tenth of a second timing to allow more accurate timing during last minute of play. Track-timing interface displays track-timing information from automatic-timing systems on football scoreboard
   iv. Connection Options:
      1. Direct wire, powered through control cable
      2. Radio
      3. Battery operation with radio - fully autonomous

g. Options to be provided:
   i. Team Name caption in place of HOME caption
   ii. Digit Style: SpectraBrite™
   iii. Digit Color: Combination Red and Amber
   iv. Color Options: Custom two-tone color to the scoreboard
   v. Finish: Perma-Coat protection to finish and vinyl
   vi. Border Trim Striping Style: Curve
   vii. Clock Striping Style: Curve
   viii. Lettering: Standard
   ix. Multi-Sport Captions Plates
   x. Controller Clock Handswitch for second operator
   xi. Radio Controller
   xii. School and/or Sponsor Signs
   xiii. Scoreboard Accents: truss
   xiv. Clocks and Timers

PART 3 - EXECUTION

3.1 INSTALLATION

A. Goal Posts and Soccer Goals: Install per manufacturer’s recommendations.

B. Field Corner and Finish Line Markers: Install as shown on the drawings. Use proper surveying equipment to assure accurately of location.

C. Radius Point Markers: Set markers in concrete as shown on the plans.

D. Field Event Equipment: install as shown on the drawings and as recommended by the manufacturer.

E. Scoreboards:
   1. Inspection: Inspect installed work of other trades and verify that such work is complete to a point where this work may commence. Verify that installation may be made in accordance with approved shop drawings and manufacturer's instructions.
   2. Discrepancies: In event of discrepancy, notify Architect. Do not proceed with installation until discrepancies have been resolved.
   3. Installation: Install where indicated, anchoring all components firmly in place in complete accordance with approved shop drawings and the manufacturer's recommendations.
      a. Coordinate footing locations with scoreboard location and siting angle. Install scoreboards in strict accordance with Manufacturer’s printed recommendations and engineering submittal.
      b. Verify height of scoreboard with Architect.
   4. Set any embedded items required for installation of signs. Use templates furnished by suppliers of items to be attached.
      Install signs level and plumb, with surfaces free from distortion or other defects in appearance.
   5. Testing and Training: Provide thorough onsite testing of completed installation and controls by manufacturer’s technical representative and instruct Owner’s representatives(s) in proper operation and maintenance of equipment.

END OF SECTION

SECTION 12 21 13

HORIZONTAL BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Horizontal blinds.

B. Related Sections:
1. Section 08 11 00 - Hollow Metal Doors and Frames; glazed openings.
2. Section 08 41 13 - Aluminum-framed Entrances and Storefronts.

1.2 SYSTEM DESCRIPTION

A. Horizontal metal slat louver blinds installed at storefront, curtain wall, glazed openings, and mirrors manual control of raising and lowering by cord; blade angle adjustable by control wand. Horizontal blinds shall be Indicated as "HB" on the drawings.

1.3 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include manufacturer's catalog cuts and data sheets, and installation instructions and data certifying blinds are lead-free.

C. Shop Drawings: Include details of attachment and schedule of each size and location.

1.4 QUALITY ASSURANCE

A. Measurements: Provide custom size blinds for the openings or mirrors in which they are to be installed. Take careful measurements of each opening so that the blinds will fit properly. Plan dimensions shall not be used. Verify head, jamb, and sill conditions.

B. All blinds shall be lead-free.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.

B. Deliver blinds wrapped and crated in a manner to prevent damage to components or marring of surfaces.

C. Store and protect products under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.

D. Store in a clean, dry area, laid flat and blocked off ground to prevent sagging, twisting, or warping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Horizontal Blinds: 1" wide by 0.0085" thick slat type, with valance for each blind. Product/manufacturer; one of the following:
Bali Classics Mini Blinds; Springs Window Fashions Division, Inc.
Levolor 1" (25mm) Riviera Classic Blind; Levolor Corp.

2.2 MATERIALS AND FABRICATION

A. Horizontal Blinds:
   1. Head channel shall be 0.025" thick Tomized steel with a plastic type coating. Channel shall be "U" shaped, approximately 1" high be 1-9/16" wide, with flanged edges at the top.
   2. Slat supports shall be braided of polyester yarn. The vertical component shall have a diameter of not less than 0.045" nor greater than 0.066". Braiding shall be accurate to hold slats equally spaced, parallel and straight, and to assure proper tilt control and adequate overlay of slats. Provide 31 rungs per 2 feet of ladder, equally spaced. Distance between ladders shall not exceed 21". The horizontal component shall consist of not less than four cables interbraided with the vertical component.
   3. Slats shall be virgin aluminum alloy approximately 1" wide by 0.0085" thick. Slats shall have sufficient crown to prevent sagging and radius corners.
   4. Bottom rail shall be 0.023" thick Tomized steel with a plastic type coating.
   5. Tilter shall be Tomized steel of enclosed construction. Unit shall tilt the slats to any desired angle and hold them at that angle. An automatic disengagement of worm and gear shall eliminate overdrive to prevent strain or damage to wand, worm, gear, ladder or top slat. Operation shall be by wand of sufficient length and swivel for easy operation.
   6. Lift cord shall be of adequate diameter, braided of high strength synthetic fibers.
   7. Finish: The factory finish for the exposed surfaces shall be a plastic type finish coat baked on. Color shall be as selected by Architect from manufacturer's standard color range.

2.3 INSPECTION

A. Examine areas to receive blinds for conditions which will adversely affect the installation of the blinds. Do not proceed with installation until unsatisfactory conditions have been corrected.

2.4 INSTALLATION

A. Attach installation end brackets at each end of blind location. For blinds over 55" long or over 50 square feet in area, provide intermediate brackets.

B. Blinds shall be mounted in brackets inside frame jambs by skilled mechanics under the supervision of an authorized representative of the manufacturer. The completed blinds shall be left clean and in perfect working order. Crates, cartons, and rubbish shall be removed from the premises; rooms shall be left broom clean.

2.5 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4".

B. Maximum Offset From Level: 1/8".

2.6 ADJUSTING

A. Adjust work under provisions of SECTION 01 77 00 - CLOSEOUT PROCEDURES.

B. Adjust blinds for smooth operation.

2.7 CLEANING

A. Clean work under provisions of SECTION 01 74 13 - PROGRESS CLEANING.

END OF SECTION

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plastic laminate-faced casework as shown on drawings.
2. The fabrication and installation of standard casework components of base cabinets, wall cabinets, storage cabinets, wardrobe cabinets, shelf units and other units as indicated.
3. The fabrication and installation of custom units, as detailed in the drawings.

B. Related Sections:
1. Section 06 10 00 - Rough Carpentry; blocking.
2. Section 08 14 23 - Plastic-laminate-faced Wood Doors
3. Section 09 65 00 - Resilient Flooring; coved rubber base.
4. Section 10 21 14 - Plastic Laminate Toilet Compartments
5. Section 11 31 00 - Appliances
6. Section 22 40 00 - Plumbing Fixtures

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions for each type of casework unit.

B. Samples: Submit 6" x 6" samples of specified finishes, including top material. Samples will be reviewed by Architect for color, texture and pattern only. Compliance with other specified requirements is exclusive responsibility of contractor.

C. Shop Drawings:
1. Submit shop drawings for plastic laminate-faced casework showing plans, elevations, ends and cross-sections. Show details and location of anchorages and fitting to floors, walls and base. Include layout of units with relation to surrounding walls, doors, windows and other building components.
2. Coordinate shop drawings with other work involved.

D. Mock-up Casework:
1. Submit one full-size sample of finished base cabinet unit complete with hardware, doors and drawers, without finish top.
2. Submit one full-size sample of finished wall-mounted cabinet unit complete with hardware, doors and adjustable shelves.
3. Furnish both hinged and rolling door samples.
4. Acceptable sample units will be used for comparison inspections at project. Unless otherwise directed, acceptable sample units may be incorporated in work. Notify Architect of their exact locations. If not incorporated in work, retain acceptable sample units in building until completion of work and remove sample units from premises when directed by Architect.

1.3 QUALITY ASSURANCE

A. Single Source Responsibility: Provide casework with tops and accessories manufactured or furnished by same casework company for single responsibility.

B. Catalog Standards:
1. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction and workmanship.
2. Custom units shall be of the same quality as standard units specified.

C. AWS Quality Standard: Comply with grades of interior architectural woodwork, construction, finishes and other requirements of the “Architectural Woodwork Standards”, 2nd Edition, 2014, adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), except as otherwise indicated.
   1. Use Premium Grade, except use Economy Grade for millwork in custodian closets and storage rooms. Items not given a specific quality grade shall be Premium Grade.

D. Color Uniformity: Provide plastic laminate for laminate-clad casework, plastic faced wood doors and plastic laminate toilet compartments from the same manufacturer.

E. Manufacturer shall have at least 5 years’ experience and have done installations for similar types of projects.

F. Accessibility Standards: The following special requirements shall be met, where required to comply with Texas Accessibility Standards (TAS).
   1. Countertop height with or without cabinet below, not to exceed a height required by TAS.
   2. Kneespace clearance to be minimum clearance as required by TAS.
   3. 12" deep shelving, adjustable or fixed not to exceed a range as required by TAS.
   4. Wardrobe cabinets to be furnished with rod/shelf adjustable to 48" A.F.F. at a maximum 21" shelf depth.
   5. Sink cabinet clearances as required by TAS.
   6. Cabinet locks, latches, and other operating mechanisms shall be mounted to comply with forward reach requirements of TAS; i.e. 15" to 48" above finish floor, except locked bottom drawers at base cabinets.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver plastic laminate-faced casework only after wet operations in building are completed.

B. Store completed plastic laminate-faced casework in a ventilated place, protected from the weather, with relative humidity therein of 50% or less at 70°F.

C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering. Woodwork damaged through neglect of the above requirements shall be repaired or replaced without additional cost to the Owner.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Install finish carpentry products only when temperature and humidity conditions have been stabilized and will be maintained.

B. Maintain temperature and moisture conditions as recommended by woodwork fabricator from date of installation through remainder of construction period.

1.6 GUARANTEE

A. Provide 5-year guarantee against defective materials and workmanship.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Manufacturer's catalog numbers for Case Systems, Inc. (website: www.casesystems.com, phone 989-496-9510) are shown on drawings and included in specifications for convenience in identifying certain cabinet work. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet, hardware, or equipment.

B. Subject to compliance with requirements of this specification, Case Systems, Inc. equivalent plastic laminate-faced casework as manufactured by one of the following will be acceptable:
   CIC Concepts in Cabinetry
   Jericho Woodworks
   Jim R. Reynolds & Assoc.

2.2 GENERAL

A. Decorative laminate casework shall be Case Systems as specified or approved equal with the following minimum features:
   1. M-3i 47# density engineered particleboard for cabinet components meeting or exceeding all requirements as set by ANSI A208.1-2009.
   2. PVC edges applied with hot melt.
   3. Epoxy coated, self-closing, minimum 150# static rated drawer slides with lifetime warranty.
   4. Non-Racking, Non-Deflecting Platform Drawer Box With 1/2" Thick Bottoms.
   5. 1/2" Thick Cabinet Back.
   6. "Balanced" High pressure laminates applied with rigid PVA glue.
   7. Thermally Fused Laminate Interior, excluding backs of doors and drawers, complying with requirements of NEMA LD3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
   8. Each Cabinet to have a factory applied, separate and full support toe base construction.
   9. Colors and finishes shall be as selected by Architect.
   10. Casework shall be independently tested to meet the following minimum performance values:

Base Unit Racking	1460 lbf
Base Front Joint Loading	725 lbf
Wall Unit Racking	1600 lbf
Wall Unit Static Load	2500 lbf
Drawer Unit Static Load	1050 lbf
Drawer Front Joint Load	805 lbf
Drawer Side Joint Load	450 lbf

   11. Rail mounted casework shall be vertically and horizontally adjustable.
   12. Rail mounted casework shall have integral lower leveling bar, adjustable from inside of cabinet.

B. Color and finish selections: Architect reserves the right to select one color for the exposed surfaces of the basic components of cabinets and a different color for the following components of cabinets: door and drawer fronts (including edges of door and drawer fronts), backs of open shelving and countertop and backsplash, unless shown otherwise.

2.3 MATERIALS

A. Exterior Vertical Surfaces:
   1. Door and drawer fronts and backs, finished end panels, and exposed exterior backs shall be surfaced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.
   2. Exterior vertical high-pressure laminate panels shall be balanced with textured .020" thick high- pressure cabinet liner conforming to NEMA Standard LD3-1995. Color as selected by Architect. Surface texture shall be similar to exterior finish.
   3. High-pressure laminate must be laminated using a PVA adhesive, set under pressure, resulting in a rigid glue line. Contact adhesives shall not be used.
   4. HPDL at open interiors, underside of wall cabinet bottoms, interiors of glazed door cabinets shall be considered exposed and finished in Decorative High-Pressure VGS laminate.

B. Plastic Laminate: General purpose grade, HGS (0.048") high pressure decorative laminate meeting requirements of NEMA LD 3. Colors shall be as selected by Architect from full color, finish and pattern range of plastic laminate manufacturers listed. Product/manufacturer; one of the following:
   Formica Brand Laminate; Formica Corp.
   Nevamar or Pionite Decorative Laminate; Panolam Industries.
   Wilsonart; Wilsonart LLC.

C. Thermally Fused Interiors at Semi-Exposed Surfaces: Interior surfaces behind doors, drawer boxes, backs, and unfinished ends shall be laminated with a thermally fused laminate that meets or exceeds the performance standards for NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Panels shall be of "BALANCED" construction. Fast cycle thermally fused, melamine foil or polyester surfaced panels or other surface types that do not meet these requirements are not acceptable. This excludes backs of doors and drawers, which shall be balanced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.

D. 3mm PVC Edges: Door and drawer edging shall be 3mm PVC. The PVC shall be applied utilizing hot melt adhesive and radiused by automatic trimmers. Hand tool applying and trimming of PVC shall not be allowed. Edging shall be available in twenty-two coordinated color options.

E. Particleboard:
1. Particleboard shall be Grade M-3i, Industrial, according to the American National Standard (ANSI) for Mat-Formed Wood Particleboard, ANSI-A208.1-2016 and shall meet or exceed the following:
a. Density 50 lbs/cu.ft.
b. Moisture Content: Meet or exceed M-3i Grade, according to ANSI-A208.1-2016
c. Modulus of Rupture 2176 psi
d. Modulus of Elasticity 362,600 psi
e. Internal Bond 73 psi
f. Linear Expansion 0.40%
g. Thickness Tolerance +/- 0.008”
h. Face Screw Holding 225 pounds
i. Edge Screw Holding 202 pounds

2.4 CASEWORK HARDWARE AND ACCESSORIES

A. Provide manufacturer's standard, satin finish hardware units, unless otherwise indicated.

B. Hinges: Institutional type, 5 knuckle. Provide one pair for doors less than 4 ft. high and 1½ pair for doors over 4'. Mill ground hospital tip tight pin feature with edges eased. Hinge to be full wrap around type of tempered steel .095" thick. Each hinge to have minimum 9 #8 screws to assure positive door attachment.

C. Wire Pulls: Solid brass with duel chrome finish, 4" wide, for drawers and swing doors, mounted with two screws fastened from back. Provide two pulls for drawers over 24" wide.

D. Door Catches:
1. Dual self-aligning, heavy-duty permanent magnet type with resistance in compliance with the Americans with Disabilities Act and Texas Accessibility Standards. Provide two catches on doors over 4' high.
2. At double-leaf doors, provide Ives No. 2 catch for leaf without the lock. Four screws per catch.
3. At each 1-1/8” doors, provide 1 flap stay No. 499.050.02.0215 or 499.050.03.0215 (Mepla) or approved equivalent.

E. Drawer Slides and Accessories:
1. Standard Drawers: Case DS230, self-closing design, epoxy powder coated with positive in-stop. Captive nylon rollers, front and rear. Minimum 100 lb. load rating.
2. File Drawers: Case DS430, full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.
3. File Drawer Rails: Case FR010, file drawer box shall have full height sides supporting the plastic file rails for hanging file folders.
4. Paper Storage Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.

F. Drawer and Cabinet Locks: Provide National Lock No. C8053-14A, half-mortise type, disc tumbler locks, round cylinder only exposed. Locks to be keyed differently, with locks in individual rooms keyed alike. Provide a masterkey.

G. Cabinet Base Molding: To be provided by General Contractor in field.

H. Adjustable Shelf Supports: Provide twin pin design with anti tip-up shelf restraints for both ¾" and 1" shelves. Design to include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip. Load rating to be minimum 300 lbs. each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection. Product/manufacturer; one of the following, no substitutions:
1. #3206 Shelf Support; Bainbridge Manufacturing, Inc.
2. SC240 Plastic Shelf Clip; Case Systems, Inc.
3. Cat. No. 282.47.402; Häfele
4. Clear Polycarbonate Shelf Clip; TMI System Design Corp.

I. Wardrobe Rod: To be 1-1/16" rod, Knape & Vogt No. 660, supported by Knape & Vogt No. 632 CHR flanges.

J. Shelf and Rod Hardware:
1 hanger rod KV660SS
1 shelf and rod support KV1195
2 rod flanges KV734
wood dowel connectors

K. Steel Support Brackets (for countertops): Provide one of the following:
   1. Concealed Work Station Brackets formed of 1/8-inch steel with powder coat finish as manufactured by A & M Hardware, Inc. (phone 888.647.0200 web site: www.aandmhardware.com). Color as selected by Architect from manufacturer's full color line.
   2. Concealed Model EH-FM Series Rakks Counter Support Brackets fabricated of minimum 0.25-inch gauge 6063-T6 extruded aluminum as manufactured by Rangine Corp. (phone 800.826.6006 web site: www.rakks.com). Brackets shall be TIG welded along both 45° mitered sides and across the back. Sharp edges shall be ground and deburred. Color and finish shall be as selected by Architect.

L. Grommets:
   1. Grommets: Max2/A-94 as manufactured by Doug Mockett & Co., Inc.
   2. Trash Grommets: 10" x 3" Trash Grommet Model No. TM10B SSS Satin Stainless as manufactured by Doug Mockett & Co., Inc.

M. Keyboard Tray: Knape & Vogt SD-04-18 Keyboard/Mouse, 6" adjustable arm, 18" track and 25" keyboard/mouse platform to accommodate right or left hand mousing.

2.5 CONSTRUCTION

A. Cabinet body components shall be secured utilizing concealed interlocking mechanical fasteners as approved by the "Architectural Woodwork Standards", 2nd Edition, October 1, 2014, as adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), Section 10 and Appendix A. They shall be especially designed for use in joining particleboard panels.

B. Joints are tight fitting and will not rupture or loosen due to the following:
   1. Dimensional changes in the particleboard.
   2. Racking of casework during shipment and installation.
   3. Normal use.
   4. Fastening devices and screws shall be treated to deter or resist corrosion.

C. Construction Features:
   1. Structural components shall be 3/4" thick with balanced surfaces.
   2. Back panels shall be 1/2" thick surfaced both sides for balanced construction.
   3. Drawer components shall be 1/2" thick surfaced both sides for balanced construction.
   4. Mounting stretchers are 3/4" thick structural components fastened to end panels by mechanical fasteners, and are concealed by the cabinet back.
   5. Maintain a 1/8" max. reveal between pairs of doors, between door and drawer front, or between multiple drawer fronts within the cabinet.
   6. When the rear of cabinets are exposed, a finished 3/4" thick decorative laminate back panel is applied.
   7. Exterior grade plywood core individual bases, factory applied to base and tall cabinets shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall. Also to conceal the top edge of applied rubber base molding. There shall be a front to back center support for bases over 30" wide.
   8. Horizontal parting rails between drawers shall be 3/4" particleboard with balanced surfaces, secured to and further reinforcing cabinet ends. When drawers are keyed individually within a cabinet, or when drawers are fitted with lock hasps, the parting rail shall run full depth of cabinet to prevent pilfer.
   9. A 5mm diameter row hole pattern 32mm (1-1/4") on center shall be bored in cabinet ends for adjustable shelves. This row hole pattern shall also serve for hardware mounting and replacement and/or relocation of cabinet components.
   10. Door and drawer fronts and finished ends shall be balanced construction with "high-pressure" laminate bonded to both sides of a M-3i, 47# particleboard core.
   11. Doors over 24" wide or 80" high shall be 1" thick.
   12. Adjustable shelves shall be particleboard core, balanced surfaces and have a .020" thick PVC front edge. Per AWS, shelving shall not deflect in excess of 1/4" when loaded.
      a. Adjustable shelves behind doors, 3/4" thick to 27" wide, over 30" wide shall be 1" thick min.
      b. Adjustable shelves in open cabinets shall be 1" thick, except for special use cabinets such as mail, cubical or locker type units.
      c. There shall be no play in adjustable shelves 1/16" each end, max.
   13. Fixed Interior Components such as fixed shelves, dividers, and cubicle compartments shall be full 3/4" thick particleboard attached with concealed interlocking mechanical fasteners.

D. Wall Cabinets:
   1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.
   2. Wall cabinet bottoms shall be of 1” thick particleboard core mechanically fastened to end panels and secured to the bottom back stretcher.
   3. An upper 3/4" thick stretcher shall be located behind the back panel with two interlocking mechanical fasteners per end. Also the stretcher is secured to the cabinet top with #8 x 2” plated flat head screws.
   4. A lower 3/4” thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. The stretcher is also secured to the cabinet bottom.

E. Base Cabinets:
   1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.
   2. Base cabinets, except sink cabinets, shall have a solid 3/4” thick sub-top fastened to the ends with interlocking mechanical fasteners.
   3. Each kneespace to have apron with dimensions per drawings.
   4. Provide 1-1/2" thick dividers between kneespaces and adjacent spaces (e.g. dishwasher openings, other kneespaces, etc.)
   5. Sink cabinets shall have a vertically mounted front stretcher panel supporting the countertop, a split removable back panel, and four steel corner gussets used to secure the counter-top.
   6. An upper 3/4” thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
   7. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.

F. Tall Cabinets:
   1. Each end panel to be secured with a minimum of eleven interlocking mechanical fasteners for a total tensile strength of 3,850 pounds.
   2. An intermediate fixed shelf shall be provided on general storage cabinets to maintain internal dimensional stability under heavy loading conditions.
   3. An upper 3/4” thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
   4. An intermediate 3/4” thick stretcher shall be located behind the back panel and be secured to the cabinet ends with interlocking mechanical fasteners. Where an intermediate shelf is present, the stretcher shall also be secured to the shelf with a #8 x 2 plated flat head screw.
   5. Drawers with 1/4” bottoms requiring hot melt glue or intermediate supports will not be permitted. No exceptions will be permitted.
   6. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.

G. Drawers:
   1. Drawer box shall be constructed with a full 1/2” thick non-racking, non-deflecting platform bottom which is carried directly by “L” shaped, bottom mount drawer glides. Sides are secured with 1 1/4” long screws directly into platform and into the sides.
   2. Sides, back, sub-front and bottom shall be 1/2” thick 47# density particleboard surfaced both faces with Light Beige, Greystone, or White thermally fused laminate per 2.02.B.1. The top edge shall be .020” PVC matching the drawer color.
   3. Corners shall be joined with fluted hardwood dowels and glue, minimum 32mm o/c.
   4. Drawer fronts shall be removable and attached drawer box sub-front with screws from inside of drawer.

2.6 PERFORMANCE

A. Laminates:
   1. “High Pressure Laminates” shall meet the definition and performance requirements of NEMA LD3-1995. Vertical grade laminate shall be VGS (0.028”) balanced with a VGS. Countertops shall be HGS (0.048”).
   2. Thermally Fused Laminate shall meet the performance requirements of NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Cabinet manufacturer shall submit panel manufacturers’ current published specification stating ANSI core properties and NEMA finish properties.

B. Hinges: ANSI 156.9.4.1,2,3,4: Two hinges mounted 23" on center on a 23-7/16" wide x 19-11/16" high cabinet door shall be capable of supporting a 100 pound test load located 1" from the outside edge of the door.
   1. Cycle, open and close, from 5 degrees open through 95 degrees open with no failure to hinges, door, or cabinet end panel. The maximum horizontal permanent hinge set shall not exceed .030".

C. Drawers: ANSI/BHMA A156.9-1988 4.11: an actual production drawer box with an applied finished front and 450mm drawer slides mounted per the manufacturers' instructions shall be tested as follows:
   1. Dynamic Cycle Test: When uniformly loaded with 100 pounds and tested through 50,000 opening and closing cycles, the drawer shall operate freely.
   2. Static Edge Load Test: When the drawer is fully extended, a 150 pound load shall be supplied to the drawer front at a point on the centerline of the drawer for one minute. No permanent damage or distortion shall occur.

D. Adjustable Cabinet Shelving: Shelving shall not deflect in excess of 1/4" when loaded with calculations per AWS Standards.

2.7 COUNTERTOPS

A. High-Pressure Decorative Laminate, Nominal 1" Thick Countertop:
   1. General Purpose, HGS (0.048") high-pressure decorative laminate on horizontal surface, conforming to NEMA Standard LD3-1995.
   2. Laminate bonded to 1" thick 45# M-3i particleboard core with PVA rigid adhesives. Contact method shall NOT be allowed. Core shall be balanced with HPL backer.
   3. Provide with 1-1/2 inch deep face edge, faced with high pressure laminate unless noted or shown otherwise.
   4. Joints shall be secured with adhesive and tight joint fasteners.
   5. Provide 4" high back splashes where shown and at ends abutting walls and adjacent cabinets.
   6. Countertops shall conform to ANSI A161.2-1979 PERFORMANCE STANDARDS FOR FABRICATED HIGH-PRESSURE DECORATIVE LAMINATE COUNTERTOPS.
   7. No joints shall be closer than 24" either side of sink cutout.
   8. No joints shall occur within kneespace.
   9. Countertops containing sinks and countertops over dishwashers shall be exterior-grade veneer core plywood or moisture resistant medium density fiberboard, no substitutions.
   10. Joint between backsplash and countertops containing sinks shall be sealed with sanitary, silicone sealant to ensure a tight seal.
   11. Seal substrate at sink cutouts with sanitary, silicone sealant.

2.8 FABRICATION

A. Fabricate plastic laminate-faced casework to dimensions, profiles and details shown.

B. Assemble units in the shop in as large components as practicable to minimize field jointing.

C. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to a flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify site dimensions of cabinet locations in building prior to fabrication.

B. Verify location of wood blocking prior to installation of finish carpentry.

3.2 CASEWORK INSTALLATION

A. Installers: Install casework under the supervision of the manufacturer's representative with factory-trained mechanics certified by manufacturer.

B. General: Install plumb, level, true and aligned with no distortions. Shim as required, using concealed shims. Where casework abuts other finished work or walls, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.

C. Base Cabinets:
1. Set cabinets straight, plumb and level. Adjust sub-tops within 1/16" of a single plane. Fasten each individual cabinet to blocking in wall with screws and finishing washers spaced 24" o.c. Bolt adjacent cabinets together into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16".
2. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24" o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.

D. Wall Cabinets
1. Securely fasten to solid blocking in partitions (not plaster, lath, or wallboard). Anchor, adjust and align wall cabinets as specified for base cabinets. Using screws with finishing washers, securely fasten each cabinet through back, near top, at not less than 24" o.c. Align similar adjoining doors to a tolerance of 1/16".
2. Adjust fronts and bottoms within 1/16" of a single plane.
3. Reinforcement of stud walls to support wall-mounted cabinets will be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.

E. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 INSTALLATION OF TOPS

A. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no jobsite processing of top and edge surfaces.

B. Fastenings: Use concealed clamping devices for field joints, located within 6" of front, at back edges and at intervals not exceeding 24". Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Secure tops to cabinets with "Z"-type fasteners or equivalent, using two or more fasteners at each front, end and back.

C. Workmanship:
1. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Provide flush hairline joints in top units using clamping devices.
2. After installation, carefully dress joints smooth, remove surface scratches, clean and polish entire surface.
3. Provide holes and cutouts as required for mechanical and electrical service fixtures.
4. Provide scribe moldings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use permanently elastic sealing compound recommended by manufacturer.

3.4 INSTALLATION OF ACCESSORIES

A. Install in a precise manner in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.

B. Demonstration Mirror: Position mirror supports with mounting plates where shown on drawings. Fasten pre-drilled mounting plates to structure with bolts. Level supports to ensure mirror rotation.

C. Install grommets at knee spaces where electrical/telephone/data outlets are installed below countertop, whether detailed on drawings or not.

3.5 CLEANING AND PROTECTION

A. Clean Up: Remove cartons, debris, sawdust, scraps, etc., and leave spaces clean and casework ready for Owner's use.

B. Repair or remove and replace defective work as directed upon completion of installation.

C. Clean shop-finished surfaces, touch-up as required and remove or refinish damaged or soiled areas, as acceptable to Architect.

D. Protection: Advise contractor of procedures and precautions for protection of materials and installed plastic laminate-faced casework from damage by work of other trades.

END OF SECTION

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SECTION 12 93 00

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide and install the following:
   1. Wheel Stops
   2. Removable Pipe Bollards.

B. Related Sections:
   1. Section 32 13 13 - Concrete Paving.

1.2 SUBMITTALS

A. Product Data: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include catalog, cuts of each type of sign and manufacturer's installation instructions.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle signs in accordance with SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS and SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS and in manufacturer's cartons. Store off ground on planking. Cover with non-staining plastic.

1.4 PROJECT CONDITIONS

A. Coordinate installation of site furnishings with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Site signs: As manufactured by Sa-So (Sargent-Sowell, Inc.) 1185 108th Street, Grand Prairie, Texas 75050 (phone 647-1525), or approved equivalent.
   1. General: Site signs shall be of the quality manufactured by Sa-So and are listed by Sa-So catalog numbers for convenience in identification.
   2. Aluminum Sheets: ASTM B 209, alloy 6061 T6, degreased and etched, 0.080" thickness. Sign faces shall be fully reflectorized with material conforming to Mil. Spec. MIL-R-13689A.
   3. Bolts, Nuts, Washers, and Clamps: Cadmium or galvanized steel. Bolts shall be a minimum of 5/16" in diameter. Clamps shall be two-piece assemblies of at last 14 gage steel or shall be an adjustable steel strap bracket.
   4. Posts: Standard galvanized steel pipe 2⅜" in diameter and weighing not less than 2 lbs. per linear foot.
   5. Concrete: Provide concrete consisting of Portland cement (ASTM C 150), aggregates (ASTM C 33), and clean water. Mix materials t obtain concrete with a minimum 28-day compressive strength of 2500 psi, using at least 4 sacks of cement per cubic yard, 1" maximum size aggregate, maximum 3" slump, and 2% to 4% entrained air.

B. Wheel Stops: Precast, air-entrained concrete; 2500-psi minimum compressive strength; approximately 6 inches high, 10 inches wide, and 84 inches long. Provide chamfered corners and drainage slots on underside, and provide holes for dowel-anchoring to substrate.

C. Embedded Removable Pipe Bollards: Provide Model CBR-RE, with padlock receiver and lid to cover the empty embedment sleeve, for round pipe bollards as manufactured by Creative Pipe, Inc. or one of the following manufacturers:
   Cal Pipe Manufacturing (1-800-536-2248)
   Columbia Cascade Company (1-800-547-1940)
   Ironsmith (1-800-338-4766)
   1. Fabrication: 6-inch ID, 0.280-inch wall, Schedule 40 steel pipe.
   2. Height: Reference drawings.
   3. Top: Domed.
   4. Mounting: Removable embedded, pad lockable.
   5. Finish: Hot-dipped galvanized.
   6. Accessories: Pad lockable or integral hole covers for removable bollards.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Site Sign Materials:
   1. Excavation: Drill holes of the size indicated for posts. Excavate holes to the depths indicated. Remove excess concrete and excavated soil from the site.
   2. Setting Posts:
      a. Remove loose and foreign materials from sides and bottoms of holes and moisten soil prior to placing concrete. Center and align posts in holes.
      b. Place concrete around posts in a continuous pour and vibrate or tamp for consolidation. Check each post for vertical and top alignment and hold in position during placement and finishing operations. Trowel finish tops of footings, and slope or dome to direct water away from posts.
   3. Attach signs to posts with bolts, washers, nuts and clamps.

B. Wheel Stops: Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded in holes cast into wheel stops. Firmly bond each dowel to wheel stop and to pavement. Extend upper portion of dowel 5 inches into wheel stop and lower portion a minimum of 5 inches into pavement.

3.2 CLEANING

A. Clean exposed sign faces and galvanized surfaces and leave free of defects. Use no abrasives. Leave pavement and graded area clean and free of debris.

END OF SECTION

SECTION 13 34 16.13

GRANDSTANDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Grandstands and aluminum benches.

1.2 SUBMITTALS

A. General: Submit in accordance with Section 01 33 23.

B. Product Data: Submit manufacturer's descriptive product date for project.

C. Shop Drawings: Manufacturer to submit shop drawings sealed by a registered engineer in the State of Texas and shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the applicable code and relevant laws. Include drawings and schedules for type, location, quantity, and details of steel and aluminum components required.

A. Product Sample:
1. Submit one 18-inch seat sample.
2. Submit one stadium seat sample.
3. Submit color samples for stadium chairs.
4. Submit sample panel of scorer's booth metal wall panel.
5. Submit color samples for Kynar coated riser boards.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer must have ten years of experience in the manufacture of bleachers and grandstands; welders must be AWS certified.

B. Installer Qualifications: Experienced in the proper installation of stadiums, pressboxes, and grandstands.

C. Source Quality Control: Mill Test Certification.

1.4 DELIVERY AND STORAGE

A. Deliver components and other manufactured items so as not to be damaged or deformed. Package for protection during transportation and handling.

B. Unload, store, and erect in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store to ensure dryness, without moisture and with positive slope for drainage of water. Do not store in contact with other materials that might cause staining, denting, or other surface damage.

1.5 WARRANTY

A. Permanent Grandstand shall be under warranty for a period of five (5) years beginning at Date of Substantial Completion. The warranty will provide for repair or replacement of failed components due to defect in materials and workmanship of installation for the specified period.

B. Fixed Stadium Chairs: Limited Guarantee - The manufacturer shall guarantee all work performed under these specifications to be free from defects for a period of one year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Provide Grandstand Interlock 2000 with gutters as manufactured by Southern Bleacher Co. (phone 800.433.0912 website: www.southernbleacher.com). Subject to compliance with requirements of this specification, equivalent product as manufactured by one of the following will be acceptable:
Outdoor Aluminum, Inc. (800-225-4249, website: www.outdooraluminum.com)
Sturdisteel (800-433-3116, website: www.sturdisteel.com)

2.2 MATERIALS

A. All support structures shall be fabricated with ASTM A 36 steel. Shop connections shall be welded. After fabrication all steel shall be hot-dipped galvanized.

B. Aluminum: Extruded aluminum alloy, 6063-T6
1. Aluminum seats and stanchions:
   a. Anodized: Clear anodized 204R1, AA-M10C22A31, Class II.
2. Riserboard Planks:
   a. Smooth Riserboard Planks at Football Grandstands shall be extruded aluminum alloy, 6063-T6, Clear anodized.
   b. Smooth Riserboard Planks at Baseball/Softball/Auxiliary Field Grandstands shall be 70% Kynar 500 finish, color as selected by Architect.
3. Footboard Planks:
   a. 2 each nominal 2 x 10 planks; extruded aluminum alloy, 6063-T6 mill finish.

C. Half-steps shall provide equal rise and run throughout aisle. Each shall have aisle nosing with non-skid black powder coated finish or other paint system meeting AAMA 603.8-92 specifications with a hardness rating of 2H and riser closure with clear anodized finish.

D. Joint Sleeve Assembly: Extruded aluminum alloy, 6063-T6, mill finish.

E. Accessories:
1. Channel End Caps: Aluminum alloy, 6063-T6, clear anodized 204R1.
2. Cast End Caps: Aluminum 319 alloy, cast finish.
3. Hardware:
   a. Bolts and Nuts: Hot-dipped galvanized.
   b. Hold-Down Clip Assembly: Aluminum alloy 6063-T6.
   c. Structural Hardware: Hot-dipped galvanized, ASTM A 325.
4. Provide Flat Riser Board Facades where noted on drawings.
5. Provide bird screens at gutters/downspouts where shown on drawings.
6. Provide Litter Shield under entire extent of Stadium Grandstands, Home and Visitor sides.

2.3 FABRICATION AND DESIGN

A. Design Load:
1. Live Load: 10 psf on gross horizontal projection.
2. Lateral Sway Load: 25 plf seat plank.
3. Perpendicular Sway Load: 10 plf seat plank.
4. Wind Load: 30 psf vertical projection.
5. Live Load of Seat and Footboard Planks: 120 plf.
6. Guardrail: 100 plf vertical and 50 plf horizontal.

B. All shop connections shall be welded; manufactured by certified welders conforming to AWS Standards.

2.4 GUARDRAILS

A. Guardrails shall be installed on all sides of grandstands, exit steps and exit ramp.

B. Handrails shall be 1¼" min. to 1½" max. outside diameter schedule 40 anodized aluminum pipe. All open ends of rails shall be plugged with flush type metal plugs.

A. Railing Types:
   1. Install vinyl coated and galvanized chainlink railing on steel angles in areas where shown. In addition, install one 2 x 6 aluminum toeboard on front of grandstand and around wheelchair area.
   2. Install tube railings at pressbox, and other areas where shown. Railings shall be 9 gauge galvanized steel. Provide vertical rails at 4'-0" o.c. maximum.
   3. Install aluminum flat riser board railing on angles along the perimeter of the upper seating where shown.
   4. Install two-line rails on exit steps and exit ramp.

B. Connect fencing to rails and rail risers with aluminum tie wires. Use ¼"x ¾" tension bars to attach ends.

C. Rails shall not be less than 42" above the center of any seatboard on ends and back of grandstand. Reference drawings for locations where minimum is 48” high.

D. Railing shall be capable of safely sustaining a horizontal thrust of 50 lbs. per linear foot applied at right angles to the top rail, and 100 lbs. per linear foot of vertical load.

E. Install tow-line rail at front of center crosswalk.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Grandstands shall be installed by skilled mechanics under the direction of an experienced installation superintendent.

3.2 CLEANING

A. Remove protective coverings and clean exposed surfaces, leaving them free of soil and defects. Remove cartons, crates and rubbish from the premises and leave the area broom clean.

END OF SECTION

SECTION 13 34 19

METAL BUILDING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pre-engineered building system including the structural steel system primary and secondary per Design Criteria, metal roof system, canopy, wall system and all roof and wall insulation, trim and accessories as required.

B. Related Sections:
1. Section 03 30 00 - Cast-in-place Concrete
2. Section 05 50 00 - Metal Fabrications; structural frames for overhead doors
3. Section 08 33 23 - Overhead Coiling Doors
4. Section 09 91 00 - Painting; field painting exposed structure

1.2 SUBMITTALS

A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include complete erection drawings showing anchor bolts settings, sidewall, endwall and roof framing, transverse cross sections, panel layout, flashing and trim details.

B. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit a 12" long by actual width sample of roofing and siding panels, with required finish.

C. Letter of Certification: Submit written Certification prepared and signed by a Professional Engineer, registered to practice in the State of Texas, verifying that building design and metal roof system (including panels, clips and support system components) meet indicated loading requirements and codes of authorities having jurisdiction. The certification must reference specific dead loads, live loads, snow loads, wind loads/speeds, tributary area load reductions (if applicable), concentrated loads, collateral loads, seismic loads, end use categories, governing code bodies including year and load applications.

D. Welders Certification: Provide copy of welder's certification. Welders must show proof of certification/ qualification prior to starting any welding on the project.

1.3 QUALITY ASSURANCE

A. Design Criteria:
1. Design of metal building systems shall be based upon both strength and deflection requirements. These requirements shall meet the more stringent of the 2015 IBC or the criteria listed herein.
2. Structural Framing: Design primary and secondary structural members and exterior covering materials for applicable loads and combinations of loads in accordance with the Metal Building Manufacturer's Association's (MBMA) "Design Practices Manual" and applicable Building Code.
3. Structural Steel: Comply with the requirements of the American Institute of Steel Construction's (AISC) "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" for design requirements and allowable stresses.
4. Light Gage Steel: Comply with the requirements of the American Iron and Steel Institute's (AISI) "Specifications for the Design of Cold Formed Steel Structural Members" and "Design of Light Gage Steel Diaphragms" for design requirements and allowable stresses.
5. Welders must show proof of certification/qualification prior to starting any welding on the project. For welded connections, comply with the American Welding Society's (AWS) "Standard Code for Arc and Gas Welding in Building Construction" for welding procedures. Welding procedure and operator qualifications and welding quality standard shall be in accordance with the American Welding Society structural welding code. Inspection other than visual inspection as defined by AWS, Paragraph 8.15.1, shall be identified and negotiated prior to bidding.
6. Roof Live Load = 20 psf.
7. Total Roof Dead Load and Collateral Load = 5 psf plus frame weight but not less that the weight of the materials (including ceiling and piping or other hanging elements, if any) shown on the contract documents.
8. Roof purlins shall be capable of supporting concentrated loads such as mechanical loads, sprinkler loads, sectional overhead doors.
9. Wind Load = 138 mph (3 sec gusts), Exposure C.

10. Metal roof panels shall not provide a diaphragm or lateral stability for purlins.
11. Roof Panel System shall meet UL Class 90 uplift requirements.
12. The General Contractor is responsible for obtaining and installing the building frame anchor bolts. The manufacturer shall provide design loads and/or the anchor bolt size required. The General Contractor shall verify the anchor bolt lengths do not extend beyond the concrete foundation dimensions. The General Contractor shall verify that all bids meet the above minimum design criteria, including the requirements for Collateral Load of 5 psf.

B. Certain characteristics as dimensioned, detailed and specified shall not vary, including:
1. Roof decking and insulation systems.
2. Wall enclosure systems, insulation, etc. Including locations and sizes of openings, etc.
3. Column locations.
4. Primary frame locations and spacing.
5. Secondary frame spacing (purlins, girts, etc.), except to reduce dimensions.
6. Shape or gauge of exposed sheet metal gutters, fascia, flashing, etc.
7. Roof slope or direction of slope.
8. Bracing of interior drywall and masonry partitions to roof structure.
9. Non-tapered columns for rigid frames.

C. Certain characteristics as dimensioned, detailed and specified shall be allowed to vary to accommodate alternate framing, including:
1. Member sizes, except where clearances with scheduled ceiling heights, ductwork and piping, etc., as designed, create conflicts.
2. Concealed portions of flashings, except as required to maintain watertightness and system integrity.
3. Bracing methods, except where architectural elements create conflicts. Minor adjustments may be made by the Architect to accommodate bracing requirements. No X-bracing allowed at the batting cages, may make modifications to portal frame locations and numbers.

D. Installation of the pre-engineered building system shall be performed by one of the following:
1. Authorized builder or contractor of the manufacturer having a minimum of 5 years' experience in installations of this type.
2. Contractor authorized by the manufacturer as trained and qualified to erect the manufacturer's product and have a minimum of 5 years' experience in installations of this type.

E. Manufacturer's Qualifications:
1. Provide pre-engineered metal buildings as produced by a manufacturer with not less than 10 years successful experience in the fabrication of pre-engineered metal buildings of the type and quality required.
2. IAS accredited according to the International Accreditation Service's AC472, "Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems", as set forth in the International Building Code, Section 1704.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver preformed metal roofing panels and trim items to the project site with no dents, scratches, or abraded areas. Deliver in manufacturer's standard bundles, securely bound and store at the project site raised above slab or ground level on pallets.

1.5 WARRANTY

A. Special Project Warranty: Submit two executed copies of standard 2-year "Roofing Guarantee" on form included at the end of this section, covering work of this section, including roofing panels, trim, sheet metal flashing, roof insulation and roofing accessories, signed by installer (roofer).

B. Furnish to the Owner written 20-year warranties for the following:
1. 20-year material failure warranty covering the cost of material and labor to repair, repaint, or replace materials not to exceed $.80/SF for the aggregate of all claims.
2. 20-year weathertightness warranty to repair or stop any leaks not to exceed $.50/SF for the aggregate of all claims.
3. The warranty dollar limits noted in items 1. and 2. above, shall be additive so that the aggregate value of the dollar limit of all claims shall not exceed $1.30/SF.
4. 20-year warranty that coating shall not blister, peel, crack, chip or experience material rust-through for 20 years. For a period of 20 years, chalking shall not exceed #8-ASTM and fading shall be 5 ΔE Color Difference Units or less.

PART 2 - PRODUCTS

2.1 ACCEPTABLE PRODUCTS/MANUFACTURERS

A. Provide pre-engineered building as manufactured by one of the following:
   MR 24 Roof Panels/BR II Wall Panels; Butler Manufacturing Co.
   (phone 816.968.3304 web site: www.butlermfg.com)
   SSR Panel/PBR Panel; Red Dot Buildings
   (phone 800.657.2234 web site: www.reddotbuildings.com)

2.2 MATERIALS: STRUCTURAL FRAMING SYSTEM

A. Structural Steel Design:
   1. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings."
   2. Bolted Connections: Comply with RCSC's "Specification for Structural Joints Using High-Strength Bolts."
   3. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses
   4. The structural system will be designed in accordance with a specified building code. (Refer to Design Loads and Building Codes).
   5. Anchor bolts shall be designed using loads provided by manufacturer.

B. Primary Framing:
   1. Rigid Frames
      a. Frames shall consist of welded-up plate section columns and roof beams complete with necessary splice plates for bolted field assembly.
         1) All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
         2) Columns and roof beams shall be fabricated complete with holes in webs and flanges for the attachment of secondary structural members and bracing except for field work as noted on manufacturer's erection drawings.
      b. All bolts for field assembly of frame members shall be high strength bolts as indicated on erection drawings.
   2. Endwall Structurals:
      a. The endwall structurals shall be cold-formed channel members designed in accordance with the 1986 AISI Specification or welded-up plate sections designed in accordance with the 1989 AISC Specification.
      b. Endwall frames shall consist of endwall corner posts, endwall roof beams and endwall posts as required by design criteria.
         1) All splice plates and base clips shall be shop fabricated complete with bolt connection holes. All base plates, cap plates, compression splice plates and stiffener plates shall be factory welded into place and have the connection holes shop fabricated.
         2) Beams and posts shall be shop fabricated complete with holes for the attachment of secondary structural members except for field work as noted on manufacturer's erection drawings.
      c. Intermediate frames shall be substituted for endwall roof beams when specified.
         1) Necessary endwall posts and holes for connection to the intermediate frame used in the endwall shall be shop fabricated.

C. Secondary Structural Members:
   1. Purlins and Girts
      a. Purlins and girts shall be "Z" shaped, precision roll formed.
   2. Eave Struts: "C" sections.
   3. Bracing
      a. Bracing shall be located as indicated on drawings.
      b. Diagonal bracing shall be hot-rolled rod of size indicated on drawings, and attached to columns and roof beams as shown on the drawings.
      c. Pinned base portal frames may be substituted for wall rod bracing on buildings as required.
      d. Flange braces, purlin braces, etc., when required, shall be cold-formed and installed as indicated on drawings.

D. Finish: Hot-Dip Galvanized
   1. Structural primary and secondary framing members and bracing shall be hot-dip galvanized according to ASTM A 123. Do not paint.
   2. Galvanize steel shapes, fabrications, and assemblies after fabrication. Safeguard against embrittlement according to ASTM A 143.
   3. Store galvanized materials in an area providing free air circulation and protection from weather and damage by other construction operations until installation area is ready.
   4. Galvanized materials subject to extended periods of storage in open, exterior locations shall be given passivating treatment or light oiling to prevent humid storage stains.

E. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 to meet requirements of ASTM A780.

2.3 MATERIALS - WALL PANELS

A. Exterior walls shall be covered with precision roll-formed Butlerib® II panels as furnished by Butler Manufacturing Company or approved equal.
   1. Panels shall be 3' wide with four major corrugations, 1½" high 12" on center with two minor corrugations between each of the major corrugations the entire length of the panel.
   2. Panels shall be one piece from base to building eave.
   3. The upper end of panels shall be fabricated with a mitered cut to match corrugations of Butlerib® II roof panels and square cut for all other roof panels.
   4. The bottom end of the panels shall be straight cut.
   5. Wall panels shall be properly aligned with structurals.
   6. Panel Design: Panel design shall be in accordance with AISI "Specifications for the Design of Light-Gage, Cold Formed Steel Structural Members," and in accordance with sound engineering methods and practices.
   7. 26 gage galvanized, per ASTM Specification A 653, and painted with exterior colors of Butler-Cote® 500 FP finish system, a full strength, 70% Kynar® 500/Hylar 5000™ fluoropolymer coating. Manufacturer warrants that coating shall not blister, peel, crack, chip, or experience material rust-through for 20 years. For a period of 20 years chalking shall not exceed #8 - ASTM and fading shall be 5ΔE Color Difference Units or less.
   8. Architect shall choose from the manufacturer’s standard colors.

B. Trim material should be as follows:
   1. Exterior trim shall be of the same color as the exterior color of the Butlerib® II wall panel except the following:
      a. Eave trim, gable trim, door side flashings and header flashings to be galvanized prepainted steel with Butler-Cote® 500 FP finish system, a full strength, 70% Kynar® 500/Hylar 5000™ fluoropolymer coating.
      b. Downspouts and gutters shall be 24 gauge galvanized prepainted steel with Butler-Cote® 500 FP finish system, a full strength, 70% Kynar® 500/Hylar 5000™ fluoropolymer coating.
      c. Flashings, trims, closures and similar items shall be as detailed on drawings as supplied by the manufacturer of the panel.

C. Fasteners:
   1. Butlerib® II wall panel-to-structural connections shall be made with Torx® head Scrubolt™ fasteners, Torx® head self-drilling screws or Lock-Rivet™ fasteners. Panel-to-panel connections shall be made with Torx® head self-drilling screws, or Lock-Rivets.
   2. Lock-Rivets (optional) shall be set by a special Lock-Rivet tool.
   3. Fastener locations shall be as shown on erection drawings as furnished by Butler Manufacturing Company.
   4. All exposed fasteners shall be either pre-painted to match wall color or shall be covered with plastic color caps to match wall color.

2.4 MATERIALS - ROOF PANELS

A. Roof panels shall be roll formed MR-24 panels as manufactured by Butler Manufacturing Co. or approved equal.
   1. Architect shall choose from the manufacturer's standard colors.

B. Roof Panels: Provide drawing quality aluminum coated steel sheets complying with requirements of ASTM A 463; coated both sides with a layer of aluminum-zinc alloy (approximately 55% aluminum, 45% zinc) applied by the continuous hot-dip method. Metal thickness not less than 24 gage (0.0239").
   1. The panels shall be 2' wide with two major corrugations, with a minimum rib height of 2¾" including the seam, 24" on center. Minor corrugations (cross fluting) at 6" on center between and perpendicular to the major corrugations, will be required to stiffen panel and reduce wind noise. Panels of 9", 12", 15", 18" and 21", in lengths up to 25' shall be provided as required.
   2. Provision for a full 2½" thermal movement of the roof panel shall be accomplished by the use of clips with self-centering movable tabs and shall be non-friction creating during thermal expansion cycles. The movable tab shall be made of high strength 304 stainless steel. The clip base shall be a minimum of 16 ga. galvanized steel. The clip system shall provide a self-centering mechanism to center the clip during erection. The force required to move the movable tab shall not exceed 8 lbs.
   3. The roof shall provide for thermal expansion/contraction without detrimental effect to the roof panel when there is a 100°F. temperature difference between the inside structural framework of the building and the temperature of the roof panels.
   4. Roofing assemblies shall be installed on a minimum ¼" in 12" downslope to drain, except at endwalls which may be warped to a lesser elevation when "flat roofed" appearance is desired. All gable end panels installed below ¼" to 12" shall have sufficient elevation to provide positive drainage.
   5. Panels of maximum possible lengths shall be used to minimize end laps. Panel end splices shall allow the roof panels to expand and contract with roof panel temperature changes, with a floating splice connection. Endlaps shall be staggered 5'-0" at alternating panels. Continuous in line splices will not be permitted. Panel end laps shall be not less than 6", sealed with sealants and fastened together by aluminum clamping plates, forming a free floating splice. Sealant at end laps shall contain PVC beads to prevent expulsion of the sealant during fastening process.
   6. Ridge assembly shall be designed to allow roof panels to move lengthwise with expansion/contraction as the roof panel temperature changes, and the ridge assembly itself shall be designed to accommodate expansion/contraction in its own length caused by thermal movement.
   7. All endwall trim and roof transition flashing shall allow the roof panel to move relative to the wall panels as the roof expands and contracts with temperature changes.
   8. All sidelap sealant shall be factory applied.
   9. Material used in flashing and transition parts shall match the roof panel materials, be compatible, and shall not cause a corrosive condition. Copper and lead materials shall not be used with zinc or aluminum coated panels.

C. Fasteners:
   1. All connections to roof panels shall be made with clips with movable tabs that are seamed into the standing seam sidelaps. Panel-to-panel connections shall be made with positive field formed double lock standing seam.
   2. Exposed fasteners are permitted at the eave and splice only.
   3. Exposed eave fasteners shall be aluminum-zinc coated or stainless steel.
   4. Splice fasteners shall be stainless steel.

D. Metal Accessories: Provide miscellaneous items as required for installation of work; all trim and metal flashing associated with the preformed metal panels shall receive the same finish as panels.
   1. Pipe flashing units shall be constructed of E.P.D.M. (ethylene Propylene Diene Monomer) rubber as manufactured by DuPont (Nordel 1440 Hydrocarbon). Unit shall be black in color with a ductile aluminum (Alloy A1100-0) reinforcing ring bonded to a rubber flange on the base of the flashing unit.

E. Sealant: Provide one-part elastomeric poly-urethane, polysulfide or silicone rubber sealant as recommended by roofing panel manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION AND ERECTION

A. General: Install preformed metal roofing and wall panels and related items in accordance with roofing panel manufacturer's instructions.

B. Framing: Erect structural framing true to line, level and plumb, rigid and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.

C. Purlins and Girts: Provide rake purlins with tight fitting closure channels. Secure purlins and girts to structural framing and hold rigidly to a straight line by sag rods.

D. Bracing: Provide diagonal rod or angle bracing in both roof and sidewalls as indicated. No X-bracing allowed at sidewalls of the batting cages, may make modifications to portal frame locations and numbers.

E. Framed Openings: Provide shapes of proper design and size to reinforce openings and to carry loads and vibrations imposed, including equipment furnished under mechanical or electrical work. Securely attach to building structural frame.

F. Roof Panels:
   1. Position and align panel with the eave structural member and align the panel with the panel clip.
   2. All side laps shall be field sealed by a lock-seaming device. Side lap sealant shall be factory applied.
   3. Panel end laps shall be not less than 6", sealed with sealants and fastened together by clamping plates, forming a free floating splice.
   4. Panel clips shall be attached to the secondary structural members.

G. Translucent Roof Panels: Install translucent roof panels per manufacturer's recommendations for a watertight installation.

H. All connections of roof panels to structural members shall be made with clips with movable tabs that are seamed into the double lock standing seam side lap. Panel clips shall be attached to the secondary structural members.

I. Panel-to-panel connections shall be made with positive field formed Pittsburgh double lock standing seam.

J. Standing seams shall be formed by an electrically powered mechanical lock seaming device. Hand seaming devices may be required in some areas.

K. Anchor components parts of the preformed metal roofing securely in place, providing for necessary thermal and structural movement.

L. Install and securely anchor metal flashing, trim, gutters and related items to provide a weatherproof enclosure, no fasteners shall be exposed on the exterior face of the work.

M. Upon completion of installation of gutters, test gutters for leaks. Block off downspouts and fill gutters with water. Inspect gutters for leaks, repair leaks and re-test sections of gutters until all sections are leak-proof.

N. Upon completion and during all roofing operations roof panels, gutters and other system components shall be thoroughly cleaned of filings, tailings, spatters and excess materials.

O. During all mechanical and painting operations, provide temporary protective coverings to prevent damage by overspray, solders or other contaminants.

P. Structural system shall be plumb before wall panels are attached.

Q. Panels shall be aligned and attached in accordance with erection drawings furnished by Butler Manufacturing Company.

R. All sidelaps shall be at least one full corrugation.

S. Panels shall be sealed at the base with metal closures.

END OF SECTION

ROOFING WARRANTY

WHEREAS _____

of (Address) _____

herein called the "Roofing Contractor", has performed roofing and associated work ("work") on following project:

Owner: _____

Address: _____

Name and Type of Building: _____

Address: _____

Area of Work: _____ Date of Acceptance: _____

Warranty Period: _____ Date of Expiration: _____

AND WHEREAS Roofing Contractor has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

NOW THEREFORE Roofing Contractor hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in watertight condition.

This Warranty is made subject to the following terms and conditions:

1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
   a. lightning;
   b. Peak gust wind speed exceeding 120 miles per hour;
   c. fire;
   d. failure of roofing system substrate including cracking, settlement, excessive deflection, deterioration, and decomposition;
   e. faulty construction of chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
   f. vapor condensation on bottom of roofing; and
   g. activity on roofing by others including construction contractors, maintenance personnel, other persons, and animals whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Contractor, and until cost and expense thereof has been paid by Owner or by another responsible party so designated.
3. The Roofing Contractor is responsible for damage to work covered by this Warranty, but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.

4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Contractor, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void upon date of said alterations, but only to extent said alterations affect work covered by this Warranty. If Owner engages Roofing Contractor to perform said alterations, Warranty shall not become null and void, unless Roofing Contractor, prior to proceeding with said work, shall have notified Owner in writing, showing reasonable cause for claim that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this warranty.
5. The Owner shall promptly notify Roofing Contractor of observed, known or suspected leaks, defect, or deterioration, and shall afford reasonable opportunity for Roofing Contractor to inspect work, and to examine evidence of such leaks, defects, or deterioration.
6. This Warranty is recognized to be the only warranty of Roofing Contractor on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to him in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Contractor of responsibility for performance of original work in accordance with requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

_____
Installation Company

_____
By

_____
Title

_____
Business Address

_____
Telephone Number FAX Number

ATTEST:

_____
Secretary

IN WITNESS THEREOF, this instrument has been duly executed this

_____day of _____, 20_____.

(INSERT APPROPRIATE EXECUTION FORM)

* * * * *

SECTION 13 36 13

METAL TOWERS

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes: Band tower that is a free standing and custom-engineered system.

B. Related Work:
1. Section 03 30 00 – Cast-in-Place Concrete: concrete pad for tower.

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings: Provide details of each metal fabrication, including setting drawings for anchor bolts and other required anchors.

C. Submit structural calculations prepared by manufacturer for review by project engineer. Shop drawings and calculations shall be sealed by manufacturers professional engineer registered in the State of Texas.

1.3 SYSTEM DESCRIPTION

A. Foundation where the tower column placement occurs shall be designed and constructed by the tower manufacturer.

B. Tower must be easy to erect and dissemble for ease of relocation. Primary tower structure to be fully welded at the factory for ease of installation.

C. The deflection due to live load of structural members supporting floors shall not exceed L/360 of the span.

D. Wind Load, Seismic Load and Drift (lateral deflection) shall be limited to that allowable by the International Building Code (IBC).

E. Design criteria for the structure shall comply with specific requirements for appropriate application live load and required top of deck height.

1.4 QUALITY ASSURANCE

A. The system manufacturer shall be an established firm with a minimum of 10 years of documented experience in the design and fabrication of custom steel structural systems.

B. The system shall be designed under the direct supervision of a professional engineer experienced in the design of towers in accordance with specifications and national model building codes.

C. Installation contractor shall be a company experienced in installing tower systems.

1.5 WARRANTY

A. The manufacturer will warrant the tower to be free from manufacturing defects for a period of one year.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Provide Sports/Band Filming & Viewing Tower System with Closed End Gable Roof on Viewing Platform as manufactured by Porta-King Building Systems, Earth City, MO (phone: 800-456-5464, website: www.portaking.com)

B. Substitutions: Manufacturers other than Porta-King Building Systems shall submit sufficient information to demonstrate compliance with design and performance requirements specified herein, listing any exceptions, and with a minimum of 10 years' experience in the design and fabrication of custom steel structural systems.

2.2 MATERIALS

A. General:
1. The tower and foundation shall be a custom engineered, freestanding structure. Designed to be in compliance with IBC code requirements. Items not specifically covered by this specification shall be governed by local codes.
2. For security and safety, tower structure shall be fully enclosed at the base and up to 16' in height. This to prevent unauthorized access to the tower above.
3. The top viewing platform shall be 16'-0" above the base of the tower and the overall footprint of the tower shall be 5'-6" x 9'-2".

B. Framing: All framing shall be structural steel tubing and angle framing. Structural components shall be sized to satisfy the structural specifications. The chemistry will equal or exceed that of ASTM A500-Grade B requirements or A36 requirements. Cold-formed "C" channels are not acceptable.

C. Base Plate Connections: Base plates shall be fully welded around the entire perimeter of the tower column. Base plates shall be centered on the column to facilitate a uniform transfer of axial loads and base shear to the foundation. Base plates shall be prepped for a minimum of 1" bed of grout. Minimum base plate thickness shall be 3/4".

D. Columns: Structural support columns shall be sized to satisfy the structural specifications. The chemistry will equal or exceed that of ASTM A500-Grade B requirements. The column section will be of square tube profile, since it has equal strength in both of the principle axis and can facilitate a welded connection. The minimum diameter size of the square tube will be 3-1/2" x 3-1/2" x 3/16" wall thickness.

E. Angles: Structural angles shall be a minimum of 4" x 3" x 1/4". The chemistry will be equal or exceed ASTM A36.

F. Stair:
1. Galley Stair assembly will have grip strut treads field bolted to stringers.
2. Stair width shall be 24". Maximum rise per tread shall not exceed 9-5/8". Minimum run per tread shall not be less than 7-11/16".
3. Stair shall maintain a minimum headroom clearance of 6'-8".
4. Stringer and tread components shall have a chemistry, which equals or exceeds that of ASTM A36 requirements.
5. The stair stringers will be a minimum of MC10x8.4.
6. The treads will be grip strut 1-1/2" x 14 ga., 4 diamond 9-1/2" deep x 24" wide.
7. The stair rails shall be 1-1/2" square tubing, factory welded to the stringers. Guard at 42" high and handrail at 34" high with expanded metal enclosure to satisfy public access requirements.

G. Guardrail: Guardrail will be at least 42" high, framed, and expanded metal public access railing. Guardrail shall be assembled at the factory to be comprised as a welded, one-piece assembly. The guardrail shall fasten directly to the tower frame to achieve maximum strength and rigidity. The chemistry will equal or exceed that of ASTM A36 requirements. All rails will be framed expanded metal. Guardrails to be surfaced mounted to the frame. All guardrails shall be fastened to the frame using 3/8" bolts.

H. Landing: Depth of landing will not be less than the width of the stairs. All observation landings will cantilever off of the main structure of the tower.

I. Finish: The tower will be galvanized for exterior use.

J. Decking: Standard decking shall be Grip Strut 2” x 14 ga. factory welded to landing surfaces. Manufacturing capacity ratings must be corrected to satisfy L/360 deflection criteria.

K. Door Hardware: Provide all hardware necessary for a complete, secure installation, including, but not limited to, hinges and latches with hasps for Owner-Provided padlocks.

2.3 FABRICATION

A. Fabrication of materials will comply with dimensions, profiles and gauges shown on the approval drawings.

B. System design to be performed by a professional structural engineer registered in the State of Texas. Design performed by technicians through the use of charts is unacceptable.

C. All design and analysis must be done under the direct supervision of a Professional Engineer.

D. Any exceptions taken to this specification must be submitted in writing..

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect working areas to insure that job site is cleared and free of all debris and obstacles so installer shall have adequate access to the work area.

3.2 PREPARATION

A. The tower contractor’s technician shall make an inspection of the job site prior to preparation of approval drawings.

3.3 INSTALLATION

A. The structural capacity of the foundation shall be per shop drawings.

B. Foundation shall be true and level, with no deviations.

C. Installation of the tower and accessories shall be in accordance with the manufacturer’s instructions.

END OF SECTION

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VLK

PROJECT MANUAL VOLUME 2

JANUARY 6, 2025

New Caney High School Extracurricular Improvements - Phase III

NEW CANEY ISD

NEW CANEY, TEXAS

VLK Project No.

23-155.00

OWNER:

NEW CANEY ISD

21580 Loop 494

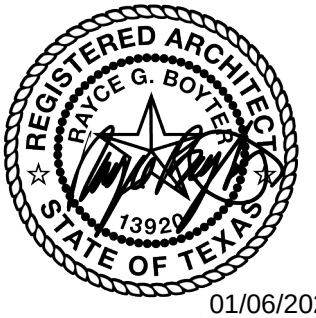
New Caney, Texas 77357

OWNER

New Caney
Independent School District
21580 Loop 494
New Caney, Texas 77357

ARCHITECT

VLK
Rayce Boyter
20445 State Hwy 249, Suite 350
Houston, Texas 77070
Main Phone: 281.671.2300
www.vlkarchitects.com



01/06/2025

CIVIL ENGINEER

Talon Engineering, LLC
Firm Registration Number: F-24281
Brian W. Reed, P.E.
1118 Wolfs Knoll
Houston, Texas 77094
Main Phone: 832.287.9874
www.taloncivil.com

LANDSCAPE/IRRIGATION

GreenScape Associates
Brett Legendre, RLA
5030 Bryan Road
Richmond, Texas 77469
Main Phone: 281.341.9975
www.greenscapeassociates.com

PROJECT MANUAL VOLUME 2

JANUARY 6, 2025

New Caney High School Extracurricular Improvements - Phase III

NEW CANEY ISD
NEW CANEY, TEXAS

VLK Project No.
23-155.00

FOOD SERVICE

FCA Design, Inc.
Randy Reich
11200 Broadway, Suite 2362
Pearland, Texas 77584
Main Phone: 281.520.3431
www.fcadesign.com

STRUCTURAL ENGINEER

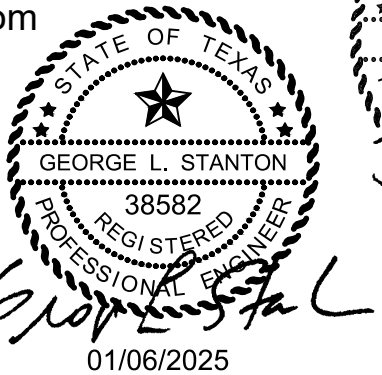
Matrix Structural Engineers, Inc.
Firm Registration Number: F- 2640
Khalil Tabaja, P.E.
5177 Richmond Avenue, Suite 670
Houston, Texas 77056
Main Phone: 713.664.0130
www.matrixstructural.com

Matrix Structural Engineers
TBPE Firm Registration No. F-2640

01/06/2025

MEPT ENGINEER

Stanton Engineering Group
Firm Registration Number: F-016332
George Stanton, PE
1300 W. Sam Houston Parkway S, Suite 121
Houston, Texas 77042
Main Phone: 713.300.9292
www.stanton-eng.com



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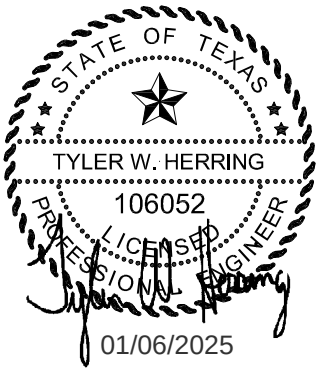

01/06/2025

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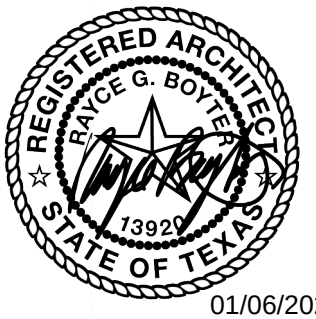

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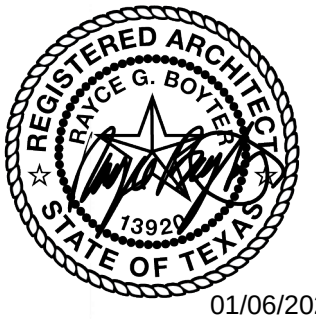

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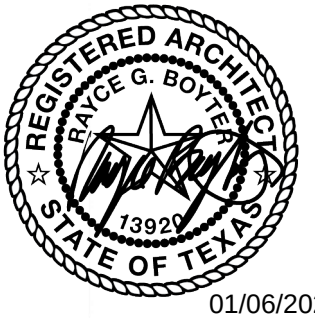

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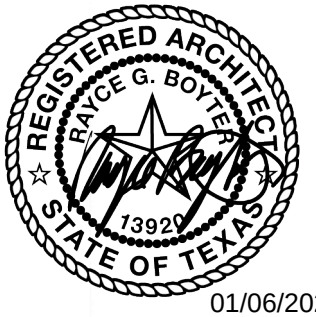

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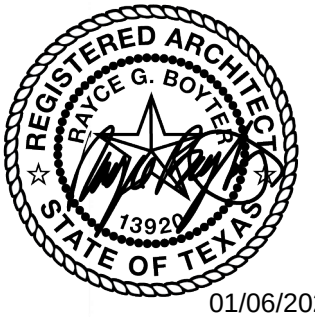

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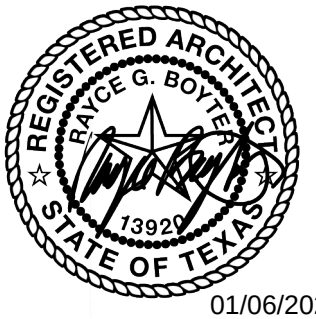

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SECTION 21 13 13

FIRE SPRINKLER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

1.2 GENERAL REQUIREMENTS

A. Systems and installation shall comply with the requirements of City Fire Marshall, applicable NFPA codes, FM/UL approving agencies and the State Board of Insurance requirements.

B. Provide all piping and equipment shown on the drawings, and all accessories necessary for a complete operating system.

C. Sprinkler piping shall not be installed over electrical panels or transformers.

D. All sprinkler piping shall be manufactured in the United States of America by American Tube, Wheatland Tube or Allied Tube.

E. Prospective contractors use the provided flow test, or shall conduct their own flow test the domestic water utility system at a fire hydrant nearest the proposed fire line connection prior to bidding to determine the conditions that he must design to. A safety factor must be applied to these conditions based on his experience to accommodate time of day and time of year variations. Do not assume a residual pressure higher than 46 psi. ***The minimum allowable safety factor shall be 10% of the available pressure***.

F. The contractor who is awarded the contractor must conduct a 2nd flow test prior to submitting shop drawings for review, in order to verify stability of the local water supply.

PART 2 - MATERIALS AND METHODS

2.1 GENERAL

A. Engage the services of a sprinkler subcontractor who will perform detailed hydraulic calculations and system design to meet the design requirements as noted on the drawings. The subcontractor shall also furnish and install all equipment and piping according to his approved design. He shall provide all labor, scaffolding and equipment necessary for the performance of this work.

2.2 SCOPE OF WORK:

A. Make connection to water main, install double check backflow preventer with isolating O S & Y valves and 1" metered leak detector bypass in vault, post indicator valve with supervisory switch and underground main to building installed based on Civil Engineer’s Contract Documents. Refer to other sections of the specifications for piping installation and backfill requirements.

B. In location shown on drawings, install system riser including O S & Y valve, check valve, alarm valve, water motor alarm, retarding chamber and, water flow sensor. Provide fire department connection of the side of the building and connect to riser. Provide fire department test valves at appropriate places with approval of the Engineer. Piping for test valves shall not be exposed in any location unless in a mechanical room. Test valves shall be piped to the outside mechanical courtyard drain or appropriate grass area not at sidewalks.

C. Install sprinkler branch piping and sprinkler heads in all areas of the building unless noted otherwise on the Drawings.

2.3 EQUIPMENT AND MATERIALS:

A. SPRINKLERS: Provide Reliable Model G1 concealed sprinkler red glass and white ceiling disk in all areas with ceilings. Install chrome plated, upright type in mechanical rooms or other rooms with no ceiling. Similar style, extended coverage or quick response heads are also acceptable. All sprinkler heads installed in ceiling tile shall be centered in the tile. Provide metal guard on all exposed heads in gymnasiums or similar sports areas, and in mechanical or electrical rooms. Upright heads shall be a minimum of 6” below overhead structure, ducts, etc. Fusible links shall have a temperature rating of a minimum of 50°F above normal ambient temperature, 145°F minimum.

B. ALARM VALVES: UL approved alarm check valve complete with necessary trimmings, including water gongs as shown on the drawings. Provide supervising switch on interior O S & Y valves for fire alarm interconnection.

C. VALVES AND DEVICES: All sprinkler control valves, alarm check valves, check valve and accessories shall be UL listed and FM approved.

D. PIPING BELOW GRADE: UL/FM listed PVC Class 200 water pipe installed in accordance with the manufacturer’s recommendations.

E. FIRE DEPARTMENT CONNECTION: Wall type, chrome plated finish, thread size to suit local fire department hardware, 2-way threaded dust caps and chains of same material, 1/4” automatic drip, marked “Sprinkler – FDC”. Acceptable manufacturers are Reliable, Elkhart Brass and Potter-Roemer.

F. PIPING ABOVE GRADE: Schedule 40 or heavier, black steel with screwed or Victaulic joint complying with NFPA 13. Thinwall pipe is not acceptable. For every sprinkler head, tap main/branch pipe serving each individual sprinkler head on top of pipe to prevent trash from collecting at head. For all sprinkler heads in ceilings, install swing joint (return bend) over to sprinkler head. Flexible connections to sprinkler heads will be acceptable with ceiling brace. All sprinkler heads installed in ceilings shall be centered in tile. Saddle taps are not acceptable. Where piping is exposed such as in stairwells it shall be installed tight to structure and a minimum of eight feet above the floor. In finished areas with no ceiling, routing of piping shall be coordinated with the Architect for visual considerations and be painted, color selected by Architect.

G. MISCELLANEOUS PIPING: Piping exposed to view outside such as drain and test piping shall be chrome plated and installed so as not to be a pedestrian hazard or stain building.

H. SIGNS: Furnish metal signs in accordance with NFPA 13.

I. ACCEPTABLE MANUFACTURERS: Central, Grinnell, Reliable and Viking (All equipment such as retarding chamber, valves, sprinkler heads, alarms and similar items shall be from the same manufacturer.)

2.4 CONCRETE PADS

A. All equipment mounted on the floor shall have a concrete housekeeping pad. Concrete pads shall be sized for the equipment to be supplied. Pad shall exceed base dimensions by approximately 4" all around. Reinforce pads rebar including #4 bar around perimeter. Nominal thickness shall be 4”. Tool pad to form a chamfered edge.

2.5 SYSTEM TESTING

A. Testing shall be observed by the engineer’s representative. Provide a MINIMUM of 48 hours notice prior to test.

B. All underground piping shall be thoroughly flushed in accordance with NFPA 13 and 24. The flush test shall be witnessed by the proper governing authority.

C. All underground piping shall be hydrostatically tested at 200 psi for a period of two hours. Comply with NFPA 13 and 24.

D. All above ground piping shall be hydrostatically tested at 200 psi for a period of two hours. All piping, valves and sprinkler heads shall be water tight.

E. Provide inspector's test connection at the required test points. Connection shall consist of 1" tap, 1" ball valve and discharge nozzle. Test stations shall not be located exposed in finished rooms. If test station is required in finished room, piping shall be installed concealed in wall with valve located above accessible ceiling or in wall behind 12 gauge, stainless steel access panel with hinged and lockable door. Test stations shall not be located in or above ceiling of Girls/Women Restrooms, locker rooms or dressing areas under any circumstances. All test valves and drainage valves shall be piped to a floor drain in a mechanical room or to a grassy area outside building (not onto sidewalk). Test valves shall be located out in the system piping, not at the building service entrance.

2.6 SPARES

A. Provide sprinkler box with a minimum of 12 spare sprinkler heads. Provide an assortment of head types in proportion to those types installed with a minimum of two of each type. Include sprinkler head wrench to fit each type head installed.

2.7 GUARANTEE

A. All materials and installation shall be guaranteed for one year from Owner's acceptance.

2.8 PAINTING

A. All equipment exposed to view shall have a painted finish. All piping exposed to view, including in mechanical rooms, shall be painted red with two coats of industrial, epoxy enamel paint.

2.9 SHOP DRAWINGS

A. Submit seven complete sets of shop drawings checked and certified by the contractor as being checked, and lists of materials furnished under this Division. Shop drawings shall be approved before installation of the material under consideration.

B. Submit equipment, hydraulic design calculations and layout drawings for approval. These drawings shall be approved by the applicable state and insuring agencies. Alternately, contractor may submit design drawings for preliminary approval prior to submitting to governing agencies. After agency approval, resubmit to architect for final approval.

C. Submittal drawing shall show the location of electrical equipment (panels, switchboards, transformers, disconnects, etc), ductwork, mechanical equipment above the ceiling, ceiling devices, and other items that may cause conflict with sprinkler piping and sprinkler heads. Drawings shall indicate height of pipes not in mechanical rooms, and any pipe that cannot be installed above 8 feet shall be highlighted. Piping shall be coordinated with ductwork contactor and may require relocation due to mechanical/plumbing ductwork and piping constraints. Piping shall be coordinated with electrical contractor and shall not be installed over any electrical equipment, or within any clearance zones notated on the Mechanical – Electrical Coordination Detail.

D. Submittal drawing shall show the location of all drain and test valves and piping discharge. These drains shall discharge into main mechanical or air handling unit rooms if at all possible.

E. Provide a printed sheet giving brief instructions relative to all necessary aspects of sprinkler controls and emergency procedures next to sprinkler riser mains. Instruction shall be protected by glass or a transparent plastic cover.

F. These drawings shall also be approved by the applicable state and insuring agencies. The front sheet of each copy of the submittal shall have the following typed information:
   1. Job name and location.
   2. General Contractor's name, address, Project Manager's name and telephone number.

3. Submitting Sub-contractor's name, address, Project Manager's name and telephone number.
4. Suppliers company name, address, salesman's name and telephone number.
5. Signature of an officer of the Sub-contractor with date and title and a statement that the submittal materials and equipment complies with the Contract Documents.

G. Approval of these submittals shall not be construed as releasing the contractor from compliance with the contract Documents. They are a means of coordinating the work and aiding in the proper selection and installation of equipment.

END OF SECTION

SECTION 22 00 00

GENERAL PLUMBING REQUIREMENTS

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

1.2 INTENT OF DRAWINGS AND SPECIFICATIONS

A. GENERAL: Drawings and Specifications are intended to be complimentary. Any work described in either of them, will be work required under this contract. Where there is a conflict between the Drawings and Specifications it shall be clarified by RFI. Barring clarification prior to bidding the most expensive option shall be included and clarification shall be made during construction. Should any work required by the drawings and specifications be in violation of any Federal, State, County or City laws, ordinance or regulation, those laws and regulations shall prevail, and shall be complied with by the Contractor as a part of this work with no extra compensation.

B. DRAWINGS: The drawings are schematic in nature, intended to show the various components of the system approximately to scale and indicate how they are to be integrated with other parts of the building. Determine exact locations by close coordination with the Owner's Representative, job measurements, determining the requirements of other trades and reviewing all contract documents. The Drawings indicated general routing of the various parts of the systems, but do not indicated all fittings and offsets which may be required to fit the system into spaces allotted for them. The Contract shall include these items as required for a complete installation.

C. BASIS OF DESIGN: Equipment that is scheduled is the basis of the design and has been coordinated for space, installation and electrical requirements. Equipment and models from other acceptable manufacturers have not been verified or coordinated. Contractor shall verify these requirements prior to using other equipment in his bid and include any additional costs for installation of the substitute equipment.

1.3 MATERIALS

A. GENERAL: Manufacturer's printed directions shall be followed for preparing, assembling, installing, erecting and cleaning manufactured materials or equipment, unless otherwise directed. Materials, when not otherwise definitely specified, shall conform to applicable National Specifications and Standards. All materials shall be certified to not contain any asbestos or other material banned by the Environmental Protection Agency. Lead shall not be used in any material, pipe or solder in contact with the domestic water system.

B. SUBSTITUTION: The names of manufacturers and model numbers have been used in the Contract Documents to establish type of equipment and standard of quality. Where only one name is mentioned for a particular item of material, then that manufacturer is the only one acceptable. Where several names are mentioned, any one of those listed may be furnished provided submittal contains sufficient information to show complete compliance with contract Documents. No attempt has been made to determine if each manufacturer listed will produce material that will comply with all requirements of this project or will fit the allotted space.

C. SUBSTITUTION REQUIREMENTS: Requests for substitution during the bidding period, in accordance with the requirements of the Special Conditions, must be accompanied by a complete product submittal with all features, accessories and capacities noted. Large equipment must include a drawing to scale showing how the equipment and required access space will fit the available space. Acceptance for bidding does not waive the post bidding requirement for formal submittal and approval.

1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. ELECTRICAL: Power wiring is specified in the Electrical Section. Controllers and starters, unless part of a motor control center, are specified under this Section.

B. PAINTING OF EQUIPMENT, PIPING AND ACCESSORIES: Painting Section. However, all items furnished under this Section shall be kept clean and free from corrosion.

C. OPENINGS: Various Sections. The locations of all inserts and openings shall be determined under this Section and coordinated with other Sections in ample time to avoid cutting new construction.

D. EQUIPMENT AND PIPING SUPPORTS REQUIREMENTS: Refer to structural drawings, details and notes for specific support and pipe hanging requirements. Specific loading and attachment methods shall be followed to assure that individual structural members are not overloaded.

1.5 ALTERNATES

A. PROJECT ALTERNATES: Determine the scope of each specified alternate proposal by carefully reading all Divisions of the Documents. The Bid Form contains information explaining the extent of the construction to be performed under a specific alternate. Alternate proposals, which are not predominantly plumbing in scope, are described in other Divisions of these Documents. Pay particular note to re-roofing items that may necessitate adjustments to existing piping.

B. ALTERNATIVE EQUIPMENT: Certain types of equipment as listed below require the specified brand and model to be included in the base bid. At the contractor's option, he may propose equivalent equipment from one of the listed alternate manufacturers for one or more of these types of equipment. The contractor shall list in this alternate bid the name of the item, manufacturer's name, model number and the amount to be deducted from his base bid.

1.6 PERMITS, FEES AND APPROVALS

A. The contractor shall obtain and pay for all permits and fees to perform his work. He shall comply with all laws, ordinances, rules and regulations bearing on the conduct of the work specified or shown on the drawings. This applies to Federal, State and Local Codes and Requirements. Approval from the various insuring and inspection authorities shall also be obtained. Refer to Architectural sections for additional information.

1.7 PLUMBING RELATED UTILITIES

A. WATER, SEWER, STORM AND FIRE SPRINKLER SYSTEMS: These systems will be coordinated by the Civil Engineer with the various utility districts.

B. NATURAL GAS: Contractor shall contact and coordinate with the gas provider to provide service to the building. Installation of the meter shall be in accordance with the gas company's requirements and standards. Where the meter is located in paved areas, leave a minimum 48"x48" (or larger if required by the provider) block-out in the concrete for the gas piping to turn up to grade if the concrete is poured before the gas main is installed.

1.8 VISITING THE SITE

A. The Contractor shall be familiar with the Drawings and Specifications and shall have examined the premises and understand the conditions under which he will be obligated to operate in performing the contract. No additional compensation shall be allowed for failure to fully understand the requirements.

1.9 GUARANTEE

A. All equipment and materials furnished under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner unless noted to have extended warranties. All extended warranties shall be from the date of acceptance by the Owner regardless of when the equipment was delivered to the job site or started up by the contractor.

1.10 NOISE AND VIBRATIONS

A. The Contractor shall guarantee that the entire system and its component items of equipment, as installed by him, shall operate without objectionable vibration or noises. If, in the opinion of the Architect, objectionable vibration or noise is present, the Contractor shall execute such remedial measures as are necessary to eliminate such unsatisfactory operating conditions and the material and labor thereby required shall be performed at the Contractor's expense.

1.11 INSTALLATION REQUIREMENTS

A. COORDINATION: The Contractor shall cooperate with other trades on the job and make installations in the proper sequence during the construction of the buildings, and he shall notify the Architect well in advance of construction of all interference of his work with that of other trades and of building construction. This notification shall not relieve the contractor of his responsibilities to coordinate his work with the total project.

B. WORKMANSHIP: All work shall be performed in a neat workmanlike manner and in the best practice of the trade. Only workmen skilled in the trades shall be employed to perform the work included in these specifications.

C. CLEAN-UP: Keep area of operations free from accumulation of waste material or rubbish at all times. All piping above accessible ceilings shall be cleaned of cement, plaster and other construction debris prior to being concealed. The parts of the Plumbing installation which are to be painted or insulated shall be thoroughly cleaned of cement, plaster, grease, oil spots and other materials in preparation for painting or insulating.

D. EQUIPMENT PROTECTION: Do not deliver equipment to jobsite until it is actually needed for installation. Protect equipment from damage due to construction activities and the weather. Equipment allowed to stand in weather will be rejected and Contractor is obligated to furnish new equipment at no cost to Owner.

1.12 CLOSEOUT REQUIREMENTS

A. AS-BUILT DRAWINGS: Obtain a set of project drawings and keep these at jobsite during construction. During the course of construction, mark on these prints any changes which are made, noting particularly locations for those items which will need to be located for servicing. At completion of job, mark each sheet "Record Drawings", date and deliver to Architect.

B. OWNER'S INSTRUCTIONS: Provide four hours of instruction on operation and maintenance of the installed systems to the Owner's designated personnel upon completion of the system's installation.

C. CLOSEOUT MANUALS: At completion of job, furnish three copies of spare parts lists and operating instructions for all equipment furnished under this Division. These lists and instructions shall be published by the manufacturer of the equipment. Bind in 3-ring binders with project name.

D. SPARE PARTS: Upon completion of the installation, deliver to the Owner all tools and spare parts that are furnished by the Equipment Manufacturer for use with the equipment furnished under this Contract.

1.13 SHOP DRAWINGS

A. All submittals shall be submitted in PDF form. Submittal will be reviewed with comments incorporated in this PDF. After final approval, Contractor shall provide a hard copy for use at the project site.

B. The purpose of these submittals is to attempt to aid the contractor in such a manner that improper or unacceptable materials are not delivered to or installed on the job. Shop drawings shall be approved before installation of the material under consideration. Approval of these submittals shall not be construed as releasing The Contractor from compliance with the Contract Documents. All materials and equipment shall be subject to final acceptance by the Engineer at completion of construction.

C. Shop Drawings shall consist of published ratings of capacity data, detailed construction drawings, wiring and control diagrams, performance curves, installation instructions, manufacturer's installation drawings and other pertinent data. Where the literature is submitted covering a group or series of similar items, the item under consideration shall be clearly indicated. Drawings shall be submitted showing revisions to equipment layouts due to use of alternate or substitute equipment. The front sheet of each copy of the submittal shall have the following typed information:
   1. Job name and location.

2. General Contractor's name, address, Project Manager's name and telephone number.
3. Submitting Sub-contractor's name, address, Project Manager's name and telephone number.
4. Suppliers company name, address, salesman's name and telephone number.

D. Shop Drawings are required for but are not limited to the following items:

1. Plumbing Carriers, Drains & Cleanouts
2. Grease Trap & Sampling Wells
3. Pumps
4. Insulation
5. Motor Starters
6. Water Heaters
7. Gas Pressure Regulators
8. Vibration Isolation
9. Roof Pipe Supports
10. Shower Mixing Valves
11. Plumbing Fixtures & Equipment
12. Plumbing Pipe, Valves & Fittings
13. Trap Priming Manifolds
14. Acid Dilution Basin
15. Pipe Markers
16. Piping Materials

E. Major equipment in AHU/Mechanical Rooms will not be approved until contractor has submitted and received approved 1/4" scale coordination drawings of mechanical and air handling unit rooms showing sizes of proposed equipment, including access space, and mechanical and electrical equipment also located in the room.

F. If a submittal is returned to the Contractor marked "Rejected" or "Revise and Resubmit", only one (1) additional submittal will be permitted without the Contractor incurring charges for the additional re-submittals. SEG shall be reimbursed by the Contractor for any expense in connection with any necessary submission in addition to the two (2) submissions allowed. Contractor will be billed by SEG at a rate of $125/hr. for these occurrences.

1.14 PLUMBING INSPECTIONS

A. GENERAL: Contractor shall formally request inspections of any and all plumbing systems installations. Inspections shall include but not be limited to: pipe tests, underground installations prior to backfill, rough-in installations, wall cover inspections, above ceiling inspections and final inspection.

B. INSPECTION REPORTS: After each inspection, the Engineer will generate an inspection report and distribute promptly. The Contractor will then be given 7 working days from date of report to address all deficiencies listed on the report. The General Contractor shall verify that all items on each inspection report have been addressed by their subcontractors in this time period. Once verified the General Contractor shall sign-off on each deficiency listed on the report and return the signed-off copy of the inspection report to the Architect and Engineer via e-mail.

C. Contractor shall provide a MINIMUM of 48 hour notice prior to requested inspection time, no exceptions.

D. INSPECTION REPORTS: After each inspection, SEG will generate an inspection report and distribute promptly. The Contractor will then be given 7 working days from date of report to address all deficiencies listed on the report. The GENERAL CONTRACTOR shall verify that all items on each inspection report have been addressed by their subcontractors in this time period. Once verified the GENERAL CONTRACTOR shall sign-off on each deficiency listed on the report and return the signed-off copy of the inspection report to SEG via e-mail. After the signed-off report is returned to SEG, the GENERAL CONTRACTOR shall request a re-inspection by SEG to close the report. If after 7 working days no re-inspection is requested by the GENERAL CONTRACTOR to close a report, SEG reserves the right to re-inspect whenever our schedule allows, with these re-inspections still being subject to Paragraph E below.

E. TEST REJECTIONS AND RE-INSPECTIONS: If a test is rejected or a re-inspection of an issued SEG Inspection Report is found to NOT be completely addressed, only ONE (1) additional inspection will be permitted without the Contractor incurring charges for each additional inspection required. SEG shall be reimbursed $500 by the GENERAL CONTRACTOR for expenses in connection with EACH inspection in addition to the two (2) inspections allowed.

1.15 COMMISSIONING AND TEST AND BALANCE

A. Third party commissioning and an independent test and balance contractor are a part of this project. Commissioning agent and T&B contractor will be under a separate contract directly with the Owner. Refer to included specifications for commissioning and T&B.

B. Plumbing contractor shall complete the pre-function checklist for the various plumbing equipment. Checklists will be supplied by the commissioning agent.

C. Plumbing contractor shall perform system tests as required by the commissioning agent in addition to any that are described in these specifications.

1.16 DEMOLITION AND REMODELING

A. In areas of demolition, contractor shall remove all plumbing equipment, piping and devices not to be reused. Any material that has salvage value shall be offered to the Owner, and if accepted, delivered to his warehouse. If not accepted it shall be properly disposed of with the other construction debris.

B. Where existing systems serve other areas as well, they shall remain active in those areas. Cap, patch and relocate piping as required to keep systems operable.

C. Remove and replace ceilings, walls, floors and other finishes as necessary to install or modify plumbing systems.

D. Where ceilings are to be removed or replaced, adjust/reinstall existing sprinkler devices.

E. Where existing starters are to be reused, install heaters with proper size for revised loads.

F. Relocate piping as necessary to allow new or modified construction. Repair existing plumbing systems damaged by construction activities.

G. Where large equipment is to be replaced (water heaters, tanks, pumps, etc.), ensure that equipment that is an acceptable manufacturer but not the scheduled brand will fit the available space and can be installed through existing doors, louvers or windows, prior to using this equipment in the bid.

H. Where new water piping connects to the existing system, system may require partial or complete draining of water. Include the costs of shutdown, drainage, and restarting of the system. Provide isolation valves at all new connections to existing systems.

I. Where existing equipment is modified or replaced (MEP and Architectural) and interfaces with the Energy Management System, disconnect and reconnect EMS wiring, and replace sensors as necessary.

J. When new piping connects to existing piping, determine the exact location and size of the existing piping prior to fabrication or installation of new piping and related construction.

K. Where existing equipment is replaced with new, including mechanical equipment, reconfigure and extend as necessary gas, domestic water and drain piping to accommodate the new equipment. Provide new shutoff valves for domestic water and gas piping connections.

END OF SECTION

SECTION 22 00 10

PLUMBING SYSTEMS CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

PART 2 - MATERIALS AND METHODS

2.1 CLOSEOUT REQUIREMENTS

A. AS-BUILT DRAWINGS: Obtain a set of project drawings and keep these at jobsite during construction. During the course of construction, mark on these prints any changes which are made, noting particularly locations for those items which will need to be located for servicing. At completion of job, mark each sheet "Record Drawings", date and deliver to Architect.

B. CLOSEOUT MANUALS: At completion of job, furnish three copies of spare parts lists and operating instructions for all equipment furnished under this Division. These lists and instructions shall be published by the manufacturer of the equipment. Bind in 3-ring binders with project name.

C. CLOSEOUT DOCUMENTS: Provide three printed copies of the approved submittal with wiring diagrams, sequences, floor plans and graphics updated to the final installation configuration.

2.2 FINAL TESTING

A. FINAL TEST: Test underground PVC sanitary drainage piping for physical deformation by passing a mandrel of 95% pipe inside diameter through piping 8" and larger. Just prior to substantial complete, contractor shall smoke test all sanitary and vent piping to confirm that the piping system is complete, access cleanouts are properly installed and all joints are tight.

B. UNDERGROUND PIPE CLEANING AND CERTIFICATION: All underground sanitary sewer piping shall be hydro-flushed or rodded prior to substantial completion. After cleaning, contractor shall provide 3rd-party subcontractor to camera and video tape inside of all underground sanitary sewer piping and provide video tape as well as detailed report outlining quality of installation and noting exact areas of poor installation. Contractor shall repair all areas noted as problems and re-camera/video tape those areas to confirm proper installation at no cost to the Owner. Just prior to substantial complete, contractor shall smoke test all sanitary and vent piping to confirm that the piping system is complete, access cleanouts are properly installed and all joints are tight. Owner’s Representative and the Engineer shall both be present at smoke testing to review and approve. Both Owner and the Engineer must approve smoke testing of sanitary and vent systems before substantial completion can be granted.

C. GAS PIPING: Perform gas piping test as required by the Texas Railroad Commission and submit competed Texas Pipeline Safety Form PS-86B.

2.3 GUARANTEES AND WARRANTIES

A. GENERAL FOR PLUMBING SYSTEMS: All materials, apparatus and equipment furnished and installed under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner unless noted to have extended warranties.

B. LARGE GAS WATER HEATERS: Heaters shall have five-year commercial warranty.

C. SMALL GAS OR ELECTRIC WATER HEATERS: Heaters shall have three-year commercial warranty

2.4 SPARE PARTS

A. GENERAL: Upon completion of the installation, deliver to the Owner all tools and spare parts that are furnished by the Equipment Manufacturer for use with the equipment furnished under this Contract.

2.5 TRAINING

A. GENERAL: Four hours in the operation and maintenance of installed systems to the Owner's designated personnel.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL REQUIREMENTS

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

PART 2 - MATERIALS AND METHODS

2.1 CUTTING AND PATCHING

A. Coordinate the work with other trades to arrange for all holes, chases, and other spaces necessary for the installation of all components of the plumbing systems. Inform the other trades in ample time for these to be provided. Failure to comply with this requirement may necessitate cutting and patching work. If such work becomes necessary, it will be done under this Section of the specifications, and shall conform to all applicable requirements of other Sections of the Specifications.

B. Where concrete flooring or paving must be cut to install MEP systems, contractor shall take measures to prevent damaging existing underground services. Contractor shall utilize ground penetrating radar and electrical circuit tracing equipment in the area to be saw cut to determine the existence of underground services. When saw cutting, limit the depth of the cut to less than the thickness of the concrete. Breakout the concrete manually with special care in areas of possible underground services.

2.2 STRUCTURAL STEEL

A. All structural steel used for the purpose of fabricating pipe supports, pipe guides, pipe anchors and equipment supports shall conform to ASTM Designation A-36. All steel used for these purposes shall be new, clean, straight and galvanized.

2.3 CONCRETE PADS

A. All equipment mounted on the floor shall have a concrete housekeeping pad. Concrete pads shall be sized for the equipment to be supplied. Pad shall exceed base dimensions by approximately 4" all around. Reinforce pads rebar including #4 bar around perimeter. Tool pad to form chamfered edge. Nominal thickness shall be 4”. Refer to details for outdoor equipment.

2.4 PIPE SUPPORTS

A. GENERAL: Provide pipe supports and guides of size and type to support pipe as well as limit movement. Minimum size hanger rod shall be 3/8”. Piping connected to a piece of equipment shall have a support located near enough to the equipment that there will be no pipe weight supported by the equipment. In no case shall the nearest support be more than two feet horizontally from the connection point. Pipe support

material shall be selected to be compatible with the pipe material to prevent galvanic corrosion. Un-insulated copper piping shall be wrapped with gas wrap tape at each hanger (minimum 2" beyond hanger), and supports shall be hot dipped copper clad or plastic covered. Vertical copper piping shall have a minimum on one intermediate support if over five feet.

B. HORIZONTAL PIPING SUPPORT SPACING: As recommended by support manufacturer, but spaced not more than listed below:

Pipe Size	Steel Pipe	Other Pipe
1. 1" & Smaller	6 Feet	4 Feet
2. 1¼" & 1½"	8 Feet	5 Feet
3. 2"	8 Feet	5 Feet
4. 2½" to 4"	8 Feet	6 Feet
5. 6" and Larger	8 Feet	6 Feet

C. SUPPORT FROM ABOVE: Support piping near roof or upper floor from structure if sufficient strength exists. Use a method suitable for type of construction and of sufficient strength. Use threaded steel hanger rods of diameter required to safely support loads. Minimum size hanger rod shall be 3/8". Install rods through holes drilled in beam flanges, 1½" x 1½" x 8" angles welded to structural members or top cord slot at joist panel points and secure with large washers and nuts. Refer to structural drawing details for additional information. Hangers shall be manufactured by Grinnell or Tolco. Do not use perforated strap.
1. SINGLE RUNS OF PIPE, NO EXPANSION PROBLEM: Adjustable clevis type Grinnell Figure 260.
2. MULTIPLE RUNS: Trapeze hangers.
3. BEAM CLAMPS: Grinnell Figure 92 for smaller pipe
4. BEAM CLAMPS: Grinnell Figure 228 (storm or sanitary 8" and larger)

D. SUPPORT FROM BELOW: All piping near the floor, or where ceiling structure does not have sufficient strength, or where there is no ceiling shall be supported from below. Support members shall be steel pipe with base plates, or welded steel structure suitably braced. Unless described by detail on the drawings, provide Tolco Pipe Pier Supports four foot on center to support piping on the roof. Select for proper weight loading.

E. SUPPORT MATERIAL FINISH: Galvanized or cadmium plated steel. Provide hot dipped copper clad supports for copper piping.

F. PIPE SADDLES: Install 18 gauge, 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, 16" minimum length. Provide compressible gasketing between non-insulated plastic pipe and hangers. Provide insulating material between dissimilar metal.

G. PLUMBING CHASE PIPING: Plumbing piping located in chases and at individual fixtures not located at chases shall be rigidly supported and aligned using the Sumner Pipe Support and Alignment System, Hubbard Holdrite System or Unistrut with U-bolts and pipe clips.

H. SWAY BRACING: All horizontal no-hub cast iron piping larger than 4" shall have sway bracing per the manufacturer's recommendations.

2.5 VALVE AND FITTING SIZES

A. All hand valves, fittings and other piping accessories shall be size of the line in which installed unless specifically indicated otherwise on the Drawings.

2.6 VALVES, STRAINERS AND DEVICES

A. GENERAL: All pressures shown below are minimum working pressures. Provide memory stops for valves used for throttling service. All devices shall suitable for domestic water service.

B. BALL VALVE: Provide for 2" and smaller pipe: Bronze body, threaded connection, full port, Teflon seat, stainless steel trim, extension stem for insulation. Nibco T-585-70-66-EL

C. BUTTERFLY: 2½" and larger, 200# full lug ductile iron type body, EPDM stem seals and seat liner, aluminum bronze disc, 416 stainless steel stem, extended neck for insulated lines, notched top plate with handle for throttling. All valves certified suitable for dead end service with no downstream flange. Nibco LD-2000

D. GATE VALVE: Provide for copper pipe 2½" and larger only: 150# bronze, threaded connection, union bonnet, solid wedge and rising stem. Nibco T-134 or F-617-0. Nibco LD-2000-3, 200 psig butterfly valve with lever-lock operator shall be acceptable in lieu of gate valve.

E. GAS VALVES: Ball type ANSI B16.33-1981, ANSI B16.38-1978 or UL 842-1980 approved and rated at the gas pressure of application. Nibco T-580-70-UL

F. SMALL GAS COCKS: Nibco T-585-70-UL

G. SHUTOFF VALVE AT GAS METER: Rockwell plug valve with grease fittings

H. CHECK: 2" and under, 125# bronze body, bronze swing check with Teflon seat; 2½" and over 125# iron body, flanged, bronze trim. Nibco T-413-Y or W-920-W

I. UNIONS: Brass insert, ground joint

J. INSULATION PROVISIONS: Valves on insulated lines shall have stems extending through insulation.

K. BACKFLOW PREVENTER: Provide Watts Series U-909SQT preventer at makeup water connection to building chilled and heating water systems. Provide 909AG air gap drain funnel with drain line extension. No other brand or model is acceptable.

L. INSTALLATION: Ball and butterfly valves shall be installed such that handle for valve is positioned on the side of the pipe and is pulled down to close the valve. All valves above a ceiling shall be installed within 24” of the ceiling.

M. ACCEPTABLE MANUFACTURERS: Apollo, Milwaukee and Nibco

2.7 MOTORS

A. GENERAL: This section applies to motors larger than 1/2 horsepower and not part of an assembly. Select for starting torque and current, suitable to start and continuously run equipment served. Horsepower rating shown on Drawings are preferred, but motor must not be loaded more than 1.0 X nameplate horsepower. Provide larger motor if required to stay within this limitation, and include all costs for any required increases in the electrical system. All motors shall have metallic nameplates marked with information required by NEC 430-7. Motors that are controlled by inverters shall be designed for this application.

B. ENCLOSURE: Drip proof for locations protected from the weather; totally enclosed fan cooled for exposure to weather or installed inside air handling units or serving pumps. Frame construction shall be steel or cast iron with all surfaces including air passages coated with a rust inhibiting primer and finished with an alkyd or epoxy enamel paint.

C. INSULATION: Class B for maximum 40° C ambient, Class F or H or higher.

D. EFFICIENCY: Motors shall be premium efficiency type and have all copper windings.

E. SERVICE FACTOR: 1.15.

F. ELECTRICAL CHARACTERISTICS: Provide nameplate ratings the same as circuit voltage indicated on the electrical drawings. Coordinate to give proper operation with starting equipment scheduled.

G. SINGLE PHASE MOTORS: Permanent split capacitor start unless special load requires another type, resilient mounting, inherent overload protection and sealed bearings requiring no lubrication but with provisions for future lubrication.

H. THREE PHASE MOTORS: Ball bearings with grease lubrication fitting on top and drain on side or bottom. Provide sleeve bearings with oil cups for units requiring minimum noise level. Average bearing life shall be 150,000 hours.

I. ACCEPTABLE MANUFACTURERS: Allis Chalmers, Baldor, Century, General Electric, Marathon, Reliance, Siemens, US Motors and Westinghouse.

2.8 VALVE INSTALLATION

A. Ball and butterfly valves shall be installed such that handle for valve is positioned on the side of the pipe and is pulled down to close the valve. Provide access panels of adequate size for concealed valves. All valves above a ceiling shall be installed within 24” of the ceiling.

2.9 EQUIPMENT IDENTIFICATION

A. GENERAL: Each piece of mechanical equipment shall be suitably marked with the name as listed on the plans. Name shall be prominently displayed so it may be easily located and read after equipment installation. Pumps may be marked on adjacent piping.

B. The following equipment shall be marked with decal or stencil painted, 3" high letters:
1. Water Heaters

C. Install factory made arrow marker on piping in Mechanical Rooms.

2.10 PIPE IDENTIFICATION

A. Identify all new and existing system piping. Use EMED Co. Kwik-Koil Pipe Markers of appropriate legend and background color, complete with direction arrow. Select appropriate size for O.D. of piping including insulation. Markers or arrows not wrapping the full circumference of the pipe shall be tie wrapped in place, otherwise taped at each end.

B. Apply markers as follows:
1. At input and output of each piece of equipment inside building.
2. At each valve not in a mechanical room.
3. At every point a pipe enters or exits a wall or floor.
4. At intervals not exceeding 20 feet.

C. These markers shall conform to OSHA and ANSI A 13.1 Codes. Arrow markers must have same ANSI background colors as their companion pipe markers and wrap completely around pipe with 3” overlap.

D. Pipe markers and arrow markers shall be provided as follows:
1. Domestic Hot Water
2. Domestic Cold Water
3. Domestic Hot Water Return
4. Natural Gas
5. Compressed Air
6. Fire Standpipe

2.11 VALVE IDENTIFICATION

A. GENERAL: Each valve 2” and larger, except those located adjacent to the equipment they serve, shall have a tag of .050-inch-thick by 1½" diameter brass, stamped or engraved with the valve number and service symbol. Attach tag to the valve with stainless steel chain.

B. SCHEDULE: Furnish a valve schedule properly identifying the valve number and service with the exact location, the material within the pipe and the room numbers or area that the valve serves. Mark the symbol and number of all valves, exactly as the valves are tagged on the "As Built" Drawings. Provide one valve schedule, as above, installed in aluminum frame with plastic shield, and mount on wall of main equipment room.

C. CEILING IDENTIFICATION: For valves above accessible ceilings, glue red star on ceiling tee intersection nearest the valve location.

2.12 PAINTING

A. GENERAL: All piping or insulation on piping exposed to view shall be painted. Insulated pipe with required metal jacket shall not be painted. All above grade gas piping shall be painted.

B. PAINT TYPE: Industrial grade, high gloss enamel over suitable primer. Provide two finish coats.

C. COLOR CODING: (Verify with Architect prior to painting)
1. Gas Piping Yellow
2. Fire System Red

2.13 HEAT TRACE SYSTEM

A. GENERAL: Install freeze protection system on plumbing piping where noted on the Drawings.

B. MATERIALS: Raychem XL-Trace self-regulating heat tape, Catalog 5XL2-CR/CT, 5 watts per foot, 208 volts. Provide power connection kit for plugging into a receptacle, end seal and thermostat.

C. INSTALLATION: Install straight along bare pipe wrapping around valves. Tie wrap to pipe at short intervals. Installation shall be in accordance with manufacturers recommendations.

2.14 ACCESS PANELS

A. REQUIRED: Panels of size and location to provide access to all concealed valves and equipment. Obtain Architect's approval of locations and type before ordering.

B. SIZE: Minimum 12" x 12", larger where required for adequate service access.

C. WALL MOUNTED: Best suited for surface materials in which installed, constructed of 12-gauge stainless steel, complete with anchor straps, concealed hinges, dust tight door and cylinder lock, all doors keyed alike. Prime coated steel is acceptable for installation in painted surfaces. U. L. Listed for 1-1/2 hour rating.

D. ACCEPTABLE MANUFACTURERS: Acudor, Mi-Fab and Zurn.

2.15 CLEANING DOMESTIC WATER PIPING

A. Flush thoroughly, then sterilize with chlorine solution for minimum 24 hours. Strength of chlorine solution shall be a minimum dosage 50 ppm, and methods must comply with local Code and Health Authorities. System shall be flushed afterwards with clean water until remaining chlorine content is less than 0.2 ppm. At completion, there must be no discernible odor. Post warnings until sterilization is complete.

2.16 TESTING WATER PIPING SYSTEMS

A. GENERAL: Test all piping systems to assure that they are absolutely leak free. Pipe to be insulated shall be proved leak free before pipe is concealed. SEG to witness and approve all testing. If piping is concealed prior to SEG witnessing and approving testing, contractor shall expose entire piping system and re-test piping for SEG to witness and approve.

B. PRESSURE TEST METHOD: Hydraulically test domestic water piping with a minimum test pressure of 125 psig. Maintain pressure for 8 hours. During this test period, inspect all pipe fittings and accessories in the piping and eliminate all leaks.

C. FINAL TEST: Subject each piping system to its normal operating pressure and temperature for not less than twenty-four hours. The piping systems 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.

2.17 TESTING SANITARY AND STORM PIPING SYSTEMS

A. GENERAL: Test all piping systems to assure that they are absolutely leak free. Test for sanitary piping shall include the first fitting above slab (i.e. transition fitting between underground PVC and cast iron). Pipes that will contain water or sewage shall be leak tested with water. Pipe to be insulated shall be proved leak free before pipe is concealed. SEG to witness and approve all testing. If piping is concealed prior to SEG witnessing and approving testing, contractor shall expose entire piping system and re-test piping for SEG to witness and approve.

B. PRESSURE TEST METHOD: For drainage systems, plug outlet and fill piping with water to top of vent. System shall remain plugged and filled with water until after system below grade is backfilled and compacted per specification. Multistory systems shall be tested one floor at a time at ten feet of hydrostatic head without leaks. Maintain pressure for 8 hours. During this test period, inspect all pipe fittings and accessories in the piping and eliminate all leaks.

C. UNDERGROUND PIPE TESTING AND INSPECTION
1. Initial open trench underground piping tested to 10-foot head for 8 hours. SEG will inspect pipe installation, approve/reject test and approve installation for backfill.
2. Pipe to remain full of water through backfill and compaction.
3. After backfill and compaction, pipes to be topped off for 10-foot head to account for evaporation. New water level to be marked and dated on pipe.
4. Prior to concrete pour, Architect's CA (already on site for concrete pour) and Contractor to check water levels and CA to approve/reject test for concrete pour.
5. After concrete is poured and dry, Architect's CA or SEG to check water levels and approve/reject pipe tests accordingly. Test shall not be removed until approval is granted by A/E team.
6. If water drops or is released prior to A/E review after concrete is placed, then an investigation will begin immediately by the sub and GC to locate the problem. If issue is determined to be a leak then it must be located, concrete removed, corrections made, pipe re-tested and water from test left on until after re-compaction and concrete placement.

D. FINAL TEST: Test underground PVC sanitary drainage piping for physical deformation by passing a mandrel of 95% pipe inside diameter through piping 8" and larger. Just prior to substantial complete, contractor shall smoke test all sanitary and vent piping to confirm that the piping system is complete, access cleanouts are properly installed and all joints are tight.

E. UNDERGROUND PIPE CLEANING AND CERTIFICATION: All underground sanitary sewer piping shall be hydro-flushed or rodded prior to substantial completion. After cleaning, contractor shall provide 3rd-party subcontractor to camera and record inside of all underground sanitary sewer piping and provide video file as well as detailed report outlining quality of installation and noting exact areas of poor installation. Contractor shall repair all areas noted as problems and re-camera/record those areas to confirm proper installation at no cost to the Owner. Just prior to substantial complete, contractor shall smoke test all sanitary and vent piping to confirm that the piping system is complete, access cleanouts are properly installed and all joints are tight. Owner's Representative and the Engineer shall both be present at smoke testing to review and approve. Both Owner and the Engineer must approve smoke testing of sanitary and vent systems before substantial completion can be granted.

2.18 TESTING GAS PIPING SYSTEMS

A. GENERAL: All new and existing gas piping shall be tested and repaired as required for safe operation and the passing of the Texas Railroad Commission requirements. All testing shall be witnessed and approved by the Engineer and the Owner's Representative.

B. GAS PIPING TESTING
   1. Preliminary gas test as required by Code, but a minimum test pressure of 50 PSIG held for not less than eight hours without noticeable drop.
   2. Test joints with a soap solution while lines are under pressure. Repair any leaks that are detected.
   3. Final gas test shall be with a 24-inch column of mercury or a diaphragm gauge with a minimum dial size of 3.5 inches with a set hand and a pressure range not to exceed 20 PSIG with 2/10 pound increments. The minimum test pressure shall be not less than 10 PSIG and the maximum pressure shall not exceed 12 PSIG. The test shall be observed by the Engineer and the Owner's Representative for a minimum of 30 minutes with no drop in pressure.
   4. Perform gas piping test as required by the Texas Railroad Commission and submit competed Texas Pipeline Safety Form PS-86B.
   5. Provide a copy of the gas pressure test reports in the Operations & Maintenance Manual provided at closeout.

C. FINAL TEST: Subject each piping system to its normal operating pressure and temperature for not less than twenty-four hours. The piping systems 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.

2.19 SLEEVES

A. Provide sleeves for all piping passing through walls, floors not on grade and roof slabs. Make sleeves of galvanized pipe and sized to provide clearance of 1/4" around piping or pipe insulation if pipe is insulated. Set end of sleeve flush with the surrounding surface of wall or ceiling in which sleeve is installed. Floor slab sleeves shall extend 3" above floor level. Provide vented sleeves for all gas piping below floor slabs, paved areas and unventilated walls and ceiling cavities. Pipes through grade beams shall be sleeved per structural engineer's drawings. As a minimum pipe through structure shall be wrapped with 1" thick closed cell pipe insulation.

B. Sleeves through floors and through fire walls shall be fire caulked or otherwise protected to maintain the fire rating of the wall.

C. Provide 6" schedule 40 PVC irrigation sleeves buried 24" below finished grade and extended a minimum 18" beyond the curb or concrete edge on each side where indicated on the drawings. Provide brass survey markers permanently affixed to the top of the curb or pavement edges at each end. Stamp each marker with "IRRIGATION SLEEVE".

2.20 PLATES

A. Provide chromium plated wall and ceiling plates for all exposed piping, at point piping passes through walls or ceilings. Plates shall be large enough to completely cover pipe sleeves. On insulated piping, inside diameter of plates shall just exceed outside diameter of pipe covering. Plates may be omitted for pipe sizes larger than 3".

2.21 DIELECTRIC UNIONS

A. Provide dielectric insulating unions at all connections between dissimilar metals.

2.22 MISCELLANEOUS COPPER PIPING

A. GENERAL: Provide all required piping not specifically shown on the drawings but necessary for the proper operation of the systems and equipment. Piping materials, methods of installation, fittings, valves, etc., shall conform to that specified for similar piping systems.

B. PLUMBING CONNECTIONS: Make all required connections between HVAC Systems and Plumbing Systems. Pipe extensions to equipment shall be same materials as supply. Provide a valve at each and every connection between Plumbing and HVAC Systems.

C. TRAP PRIMER PIPING: Use Type K copper. Piping in contact with concrete shall be installed in a protective sleeve.

D. MISCELLANEOUS DRAINS: Provide drain line to floor drain from backflow preventers, relief valves and other plumbing equipment with automatic drains.

2.23 ROUGH-INS AND CONNECTIONS

A. SPECIAL FIXTURES AND TRIM: Provide rough-ins and connections to cabinet sinks and all trim where shown on the Drawings. Fixtures and trim requiring rough-ins and connections will be furnished loose under the special equipment section of those specifications, installation shall be under this Section. Refer to Architectural Specifications for information on prefab cabinets. Provide stops, risers and P-traps under this Section for prefab cabinets and kitchen equipment provided under the Architectural Specifications.

B. COORDINATION: The piping and connections for these areas have been indicated approximately. The exact arrangements and locations of various piping and connections shall be determined by shop drawings provided under other sections of these Specifications.

2.24 EXCAVATION AND BACKFILLING

A. GENERAL: Provide all excavation and backfilling required for the proper installation of all underground piping and other components installed below grade.

B. EXCAVATION: Trench with ladder type trenching machine. Make trenches 12" to 18" wider than outside diameter of pipe. Excavate, backfill and grade trench bottom to required slope. Verify slope with laser level or approved device. Cut out bedding for pipe joints to provide solid bearing surface for entire length of pipe. Backhoe may be used to excavate trench if bottom is properly sloped and compacted to proper grade prior to installation of the piping.

C. BACKFILLING:
1. For non-drainage lines backfill with approved backfill material to 95% standard proctor, by hand compaction.
2. For drainage lines, the lower 12” shall be backfilled with cement-stabilized sand with top surface shaped to accommodate pipe including joints, at the proper flowline. Grading shall be determined by laser level. After installation of the pipe, backfill to 1/2 the diameter of the pipe with cement stabilized sand. The remainder of the excavation shall be backfilled with approved backfill material to 95% standard proctor, by hand compaction. Do not place backfill material or second layer of cement stabilized sand until the piping and joints have been inspected and approved.

D. SAFETY SYSTEMS: Refer to Architectural Sections for additional requirements.

END OF SECTION

SECTION 22 07 00

PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Install all insulation in conformance with manufacturer's recommendations and these specifications.

B. Insulation materials manufactured by the following list of companies will be acceptable provided their materials conform to these specifications: Armstrong, CertainTeed, Knauf, Koolphen, Manville and Owens-Corning.

C. Flame Spread and Smoke Requirements:
1. All jackets, adhesives, coatings, insulating materials and vapor barrier mastics for piping and equipment shall have a flame spread not higher than 25 and smoke developed rating not higher than 50.
2. All materials containers shall have a U. L. Label.

D. At each pipe support point, provide 10” long, formed 16 gauge galvanized sheet metal saddle. For piping 1½” and larger, install a hard section of Koolphen K phenolic foam pipe insulation the same length as the pipe saddle. Seal and finish to match adjoining insulation.

E. Install .020" thick aluminum jacket with minimum 2” overlap joint on all insulated piping exposed outside building. Install factory made aluminum covers on all elbows. Cut aluminum neatly to fit all tees, such that all insulation is covered by aluminum. Use waterproofing aluminum colored Foster 95-44 or Childers CP-76-1 sealer to seal all joints. Provide .020x3/4” aluminum bands not more than 12" on center for all jacketing. Install aluminum covers on insulated pipe inside that is exposed to view in finished areas including inside gymnasiums. Cover is not required in mechanical or AHU rooms.

PART 2 - MATERIALS AND METHODS

2.1 DOMESTIC COLD WATER PIPING

A. GENERAL: Insulate all water piping outside and above grade, in exterior walls, within eight feet of exterior walls, central mechanical and boiler room piping, piping inside the building but outside the building insulation and all piping subject to condensation. Ball valves are specified to have an extended stem, per Section 22 05 00, Common Work Results. All insulation shall extend over valve bodies and be sealed around the extended stem of the valve.

B. MATERIALS FOR PIPING INSIDE BUILDING: 1" thick factory molded pipe covering insulation made with fiberglass having a density not less than 3 pounds per cubic foot. Conductivity (k) shall be .25 or less at 100° mean temperature difference. Insulation shall have a factory attached fire retardant jacket.

C. MATERIALS FOR PIPING OUTSIDE BUILDING: Insulate piping outside including backflow preventers outside with 1” thick Molded Koolphen K phenolic foam pipe insulation. Install .010” stainless steel protective jacket. Insulation and jacketing for backflow preventers shall be installed with easily removable sections to allow periodic servicing, testing and inspection of backflow preventer without damaging insulation installation or integrity.

D. INSTALLATION: Install insulation over pipe and carefully connect seal sealing laps. Provide 3" butt strips at each joint between sections, sealed with Foster 85-75 or Childers CP-82 adhesive. Coat all vapor retarder film (ASJ) longitudinal and butt joints with anti-fungal Foster 30-80AF vapor barrier coating to prevent moisture ingress. Reinforcing mesh shall be 10x10 Childers Chil Glas #10 or Foster Mast a Fab. Apply Foster 95-50 or Childers CP-76 insulation joint sealant in phenolic insulation longitudinal and butt joints to prevent moisture ingress.

E. FITTINGS: Insulate fittings with pre-molded cover of same materials and thickness as pipe covering. Coat all fittings and elbows with anti-fungal Foster 30-80AF vapor barrier coating and 10x10 Childers Chil Glas #10 or Foster Mast a Fab reinforcing mesh. Finish all joints and seams smooth and even.

2.2 DOMESTIC HOT WATER PIPING

A. GENERAL: Insulate all hot water supply and return piping, including booster heater piping and tempered water piping. Ball valves are specified to have an extended stem, per Section 22 05 00, Common Work Results. All insulation shall extend over valve bodies and be sealed around the extended stem of the valve.

B. MATERIALS: 2" thick factory molded pipe covering insulation made with fiberglass having a density not less than 3 pounds per cubic foot. Conductivity (k) shall be .25 or less at 100° mean temperature difference. Insulation shall have a factory attached fire retardant jacket.

C. EXECUTION: Secure all laps and joints with staples at 4" on center. Provide 3" butt strips at each joint between sections. Insulate fittings with pre-molded cover of same materials and thickness as pipe covering.

2.3 STORM DRAINAGE PIPING ABOVE SLAB

A. GENERAL: Insulate horizontal and vertical piping including roof drain bodies, including overflow drains and piping.

B. MATERIALS: 1½" thick flexible fiberglass blanket with vapor barrier or 1" thick fiberglass pipe insulation with vapor barrier. Insulated piping exposed to view shall be insulated with pipe insulation.

C. EXECUTION: Seal vapor retarder laps with white Foster 85-75 or Childers CP-82 and staple at 4" on center. Vapor seal staples with Foster 30-80AF. Provide 3" butt strips at each joint between sections and seal as above. Install vapor stop every 15'-0" using Foster 30-80AF. Finish all joints and seams smooth and even. Reinforcing mesh shall be 10x10 Childers Chil Glas #10 or Foster Mast a Fab. This application shall provide a minimum dry film thickness of 37 mils. Piping exposed to view in finished areas, including inside gymnasiums, shall have aluminum jacketing per specification.

2.4 SANITARY DRAIN PIPING ABOVE GRADE

A. GENERAL: Insulate horizontal piping, floor drain bodies, elbow at drain, first elbow that turns down and all piping in ceiling plenums of sanitary system serving floor and hub drains receiving condensate from air conditioning and refrigeration equipment.

B. MATERIALS: 1½" thick flexible fiberglass blanket with vapor barrier or 1/2" thick pipe insulation with vapor barrier. Insulated piping exposed to view shall be insulated with pipe insulation.

C. EXECUTION: Seal vapor retarder laps with white Foster 85-75 or Childers CP-82 and staple at 4" on center. Vapor seal staples with Foster 30-80AF. Provide 3" butt strips at each joint between sections and seal as above. Install vapor stop every 15'-0" using Foster 30-80AF. Finish all joints and seams smooth and even. Reinforcing mesh shall be 10x10 Childers Chil Glas #10 or Foster Mast a Fab.

2.5 DRINKING FOUNTAIN DRAIN LINES

A. Insulate from connections to fountains to connection to next larger size drain, or, if drain runs into floor, from fountain to floor, with 1/2" thick pipe covering the same as for Domestic Cold Water Piping.

2.6 FIRE SPRINKLER PIPING

A. Insulate all water piping outside and above grade, in exterior walls, within two feet of exterior walls, and piping inside the building but outside the building insulation (i.e. above insulation on ceiling) with 1" thick factory molded fiberglass pipe covering, density not less than 3 pounds per cubic foot, conductivity (k) not higher than .25 at 100° mean temperature difference with factory attached fire retardant, vapor barrier jacket. Piping inside mechanical rooms with local space heater or boiler need not be insulated.

2.7 LAP AND JOINT ATTACHMENT

A. Self-sealing type jackets will be acceptable provided the laps are sealed per the manufacturers recommendations.

END OF SECTION

SECTION 22 08 00

COMMISSIONING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for plumbing systems, assemblies, and equipment.

B. Related Sections:
1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

C. The cost of the Commissioning Authority shall be selected and paid directly by the Owner.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority

C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting and balancing review and coordination meetings.

D. Participate in plumbing systems, assemblies, equipment and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.5 CXA'S RESPONSIBILITIES

A. A. Provide project-specific construction checklists and commissioning process test procedures for actual plumbing systems, assemblies, equipment and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing and adjusting work is complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

A. Contractor shall provide the following information to the CxA for inclusion in the commissioning plan:
   1. Submittals, systems manuals, and other documents and reports.
   2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
   3. Schedule for completing manufacturer's prestart and startup checklists for plumbing systems, assemblies, equipment and components to be verified and tested.
   4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
   5. Notification that plumbing systems, subsystems, equipment and associated controls are ready for testing.
   6. Test and inspection reports and certificates.
   7. Corrective action documents.
   8. Testing and adjusting reports.

1.7 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation and tools to perform commissioning test at the direction of the CxA.

B. Scope of plumbing testing shall include water heating systems, compressed air systems and water softening systems.

C. Tests will be performed using design conditions whenever possible.

D. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

E. The CxA may direct that set points be altered when simulating conditions is not practical.

3.2 TESTING PREPARATION

A. Contractor shall certify that plumbing systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Contractor shall set systems, subsystems and equipment into operating mode to be tested.

C. Inspect and verify the position of each device and interlock identified on checklists.

D. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.3 PLUMBING SYSTEMS, SUB-SYSTEMS AND EQUIPMENT TESTING PROCEDURES

A. Water Heater Testing and Acceptance Procedures: Testing requirements are specified in Division 22. Provide submittals, test data, inspector record, and boiler certification to the CxA.
   1. Perform visual inspection of installation including electrical connections.

2. Perform gas system check as required by the boiler code.
3. Test operating function of safeties and relief valves.
4. Test operational control including circulation pumps.

B. Water Softener System: Provide submittals, test data and inspector record to the CxA.
1. Perform visual inspection of installation including electrical connections.
2. Test operational control including circulation pumps.

C. Compressed Air System: Testing requirements are specified in Division 22. Provide submittals, test data, inspector record, and boiler certification to the CxA.
1. Perform visual inspection of installation including electrical connections.
2. Test operating function of pressure regulating valve.
3. Test operating function of safeties and relief valves.
4. Test operating function of associated hose reels. Hose reel must fully extend and retract without undue effort.

D.

END OF SECTION

SECTION 22 11 00

BUILDING WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Piping shall be installed in a neat and orderly manner parallel to building coordinates with vertical drops.

B. Piping shall be concealed in wall, chases and above ceilings except in the vicinity of equipment such as water heaters.

C. Piping in the vicinity of equipment shall be arranged to not interfere with access panels and maintenance space. Provide unions, flanges and shutoff valves to allow removal of the equipment and its subassemblies without having to remove excessive amounts of building piping or drain water systems.

D. Piping shown underground shall be buried a minimum of 12 inches to top of pipe.

E. All materials shall conform to the City Building Code. All piping, fittings and valves shall be manufactured in the United States of America.

F. The Building Automation Contractor may provide one or more water meters to measure various building usages. Install where shown or where directed in the field. Refer to 23 09 23 Sequence of Operation for HVAC Controls for meters to be provided.

PART 2 - MATERIALS

2.1 EXTERIOR DOMESTIC WATER

A. GENERAL: This paragraph relates to all water piping below grade, all piping above grade outside of building and piping in contact with concrete.

B. MATERIALS: Type "K" copper rigid water tubing per ASTM B-42 and ASTM B-88, with solder type ASME B 16.18 cast bronze, or ASTM B 16.22 wrought copper alloy fittings. Piping in contact with ground or concrete shall be protected with PVC coating or PVC sleeve.

C. INSTALLATION: Clean inside and outside of all tubing and fittings. Make up joints with lead-free solder. Solder shall be 95.5% tin, 4% copper, 0.5% silver (lead free, antimony free, zinc-free). Silvabrite 100 by Engelhard Corporation or approved equal.

D. TESTING: Test in accordance with recommendations of AWWA.

2.2 INTERIOR DOMESTIC WATER

A. GENERAL: This paragraph relates to all piping inside of building.

B. MATERIALS:
1. All piping shall be hard drawn, copper water tube, Type "L" per ASTM B-88, with solder type ASME B 16.18 cast bronze, or ASTM B 16.22 wrought copper alloy fittings, made up with lead-free solder. Victaulic copper piping connection system or Grinnell grooved system may be used for sizes 3” and larger.
2. All individual branches serving fixtures, from surface of walls to connections to fixtures or equipment, shall be chrome plated.
3. Solder shall be 95.5% tin, 4% copper, 0.5% silver (lead free, antimony free, zinc-free). Silvabrite 100 by Engelhard Corporation or approved equal.
4. **Press Fit System is not ACCEPTABLE**
5. Below grade water piping may be soft drawn copper without joint below slab. Note only allowed where specifically shown and must be sleeved.

C. AIR CHAMBERS: Install in each water branch, at each fixture and each piece of water supplied equipment. Locate in chases or walls as close to fixture or equipment as possible. Chambers shall be minimum 24" high Type L copper.

D. WATER HAMMER ARRESTERS: Provide on both hot and cold water branches in addition to air chambers. Arresters shall be Precision Plumbing Products, Inc. or Sioux Chief, size and location shall be based on pipe size, fixture unit count and manufacturer’s recommendation.

E. VALVES: Provide shutoff valve in branch line to each piece of water consuming equipment or fixture. Stop valves serving plumbing fixtures do not require additional valve unless shown on the Drawings.

F. SLEEVES: Where water piping is shown below slabs to serve island sinks, etc. shall be encased in DWV PVC sleeve with solvent joints. Sleeve shall extend above slab.

END OF SECTION

SECTION 22 13 00

BUILDING SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Piping shall be installed in a neat and orderly manner parallel to building coordinates with vertical drops. Piping shown underground shall be buried a minimum of 12 inches to top of pipe. Piping in the vicinity of equipment shall not interfere with access panels and maintenance space.

B. Piping shall be concealed in walls, chases and above ceilings except in mechanical equipment areas.

C. Cleanouts shall be installed above the flood rim of water closets and urinals, and above the top of the drain connection of sinks, lavatories and drinking fountains.

PART 2 - MATERIALS

2.1 SANITARY SOIL, WASTE AND VENT PIPING

A. GENERAL: Provide for all fixtures, equipment and floor drains as indicated and as required by Code. Provide appropriate wye fittings and bends. Do not use sanitary tees. Do not use any fittings prohibited by the codes. Cast iron pipe shall be manufactured by Charlotte or Tyler Pipe. All piping shall comply with ASTM D1785/D2665.

B. MATERIALS:
1. ABOVE SLAB: Standard weight, centrifugally cast, bell and spigot cast iron, standard weight fittings per ASTM A-74, with Ty-seal joints. No hub piping with no hub clamps may be used if proper pipe supports are installed to maintain uniform slope and rigidity. Heavy weight, medium duty no-hub clamps shall be installed on all sanitary piping, excluding vents. Piping above inaccessible ceilings shall be bell and spigot cast iron.
2. BELOW SLAB: Schedule 40, DWV PVC
3. BELOW GRADE, BEYOND FIVE FEET FROM BUILDING: Schedule 40, DWV PVC. Pipe sizes over 6" may be heavy wall SDR-26 PVC sewer pipe meeting ASTM D3034 requirements.

C. HUB AND SPIGOT GASKETS: Hub and spigot gaskets shall be Tyler Ty-Seal, positive double seal compression type conforming to ASTM C564.

D. NO-HUB CLAMPS:
1. No-hub joints for sanitary lines shall be made with gasket and one-piece stainless steel, heavy weight, medium duty no-hub clamps (4 bands). No-hub clamps for pipes 6” and larger PIPE shall have 6 bands. Clamps shall be Husky HD 2000 or equal by Mission or Mi-Fab.
2. Gaskets for joints between PVC pipe and cast iron pipe shall be Husky SD4000 CI/PVC specifically designed for this application. Provide 4 band for sizes through 4” and 6 band for larger pipe.

3. Similar two band clamps may be used on vent piping.

E. CLEANOUTS: Install at each change of direction and at locations indicated on drawings. Exact location shall be reviewed by Architect prior to setting. Cleanouts shall be size of the line served, except maximum size of 4". Provide double cleanout for two-way rodding after each pipe exits the building. Wall cleanouts behind access panels shall be within 2" of the panel for ease of use. Where possible, cleanouts for serving plumbing fixtures shall be located above the flood rim of the fixture so that effluent does not spill out.

F. DRAINS: Floor drains installed in floors with waterproofing membranes shall have clamping collars.

G. GRADING: Continuously grade all drainage piping. Inside building, grade 1/4" per foot for lines 3" and smaller. Grade 1/8" per foot for line 4" and larger. Piping below grade beyond five feet from building shall have maximum continuous slope consistent with site conditions of existing mains to which they will be connected or 1/8" per foot whichever is less (1/4" per foot for lines smaller than 4").

H. SYSTEM CLEANING: Hydro flush or rod out all sections of sanitary waste lines prior to substantial completion.

2.2 FLOOR DRAINS

A. GENERAL: For all drains, either provide ½" trap primer tap in toilets where drain is trap primed from water closet or delete ½" trap primer tap and provide Proset Systems Trap Guard sewer gas emissions protection device as indicated on the drawings. In addition to the manufacturers listed, equipment of identical design, quality and appearance will be considered when manufactured by JR Smith, Mi-Fab, Wade or Zurn

B. TOILET ROOMS, LOCKER ROOMS, SHOWER AREAS AND SIMILAR LOCATIONS: Mi-Fab F1100C-X6-3-6 or Zurn ZS-415-6B-HD-P-VP cast iron two-piece floor drain with seepage flange, reversible clamping collar, 6" diameter, heavy duty stainless steel strainer, 1/2" trap primer tap, security screws.

C. EQUIPMENT DRAINS: Mi-Fab F1340C–TFB-3-7-22 or Zurn ZS-540-LG-P cast iron, medium depth floor drain with flange, clamping device, seepage openings with 12" stainless steel rim, less top grate but with internal ductile iron sediment bucket and 1/2" trap primer tap and Proset Systems Trap Guard sewer gas emissions protection.

D. GRATED EQUIPMENT DRAINS: Mi-Fab F1320C-3 or Zurn ZS-540-LG-P cast iron floor drain with flange, seepage openings, 9" heavy duty ductile iron grate with stainless steel veneer, clamping device and 1/2" trap primer tap and Proset Systems Trap Guard sewer gas emissions protection.

E. KITCHEN: Mi-Fab F1300C-3-7 (F4-3) or Zurn ZS-415-7N-P cast iron two-piece floor drain with seepage flange, reversible clamping collar, trap primer connection, 7" stainless steel strainer with tractor grate, riser and 1/2" trap primer tap and Proset Systems Trap Guard sewer gas emissions protection. Provide 4" diameter stainless steel funnel at indirect waste connections.

F. SANITARY FLOOR SINK: Mi-Fab FS1730-FL-C-3-175 or Zurn ZS-1901-KC-HD-3-P-32 cast iron floor sink with 8" sump, 12"x12" acid resisting enamel coated interior, heavy duty stainless steel frame and 3/4 tractor grate, ductile iron secondary dome strainer, and Proset Systems Trap Guard sewer gas emissions protection. All floor sinks shall have integral flange with seepage openings for support, clamping device and 1/2" trap primer tap.

G. ACID WASTE: George Fischer Sloane PVDF floor drain with 8" PVDF grate and 1/2" trap primer tap and Proset Systems Trap Guard sewer gas emissions protection. Equal by IPEX shall be acceptable.

H. CLOTHES WASHER TRENCH FLOOR DRAIN: Same as for toilet rooms except provide 6" diameter nickel bronze strainer with vandal proof dome grate. Mi-Fab or Zurn

2.3 CLEANOUTS

A. GENERAL: Install cleanouts at bends, angles, and at ends of all waste and sewer piping and as noted on Drawings. Bring all cleanouts up to grade and make accessible. All cleanouts shall have extra heavy PVC plugs. For cleanouts in unpaved areas, install in 18" x 18" x 6" thick concrete pad. The top of cleanout shall be 2" above grade with the pad sloping to edges at grade level. For cleanouts in paving, sidewalks, etc., install flush with finished surface. Refer to detail on Architectural Drawings.

B. MATERIALS:
1. UNFINISHED AREAS AND CHASES: Mi-Fab C1450 or Zurn Z-1440 cast iron caulking ferrule with countersunk head with PVC plug.
2. FINISHED WALLS: Mi-Fab C1450 or Zurn Z-1440 cast iron caulking ferrule with countersunk slotted head with PVC plug (full size up to 4”). Provide Mi-Fab UA-SS-VP square smooth finish, 8”x8”, 16-gauge stainless steel, vandal-proof access cover, flanged frame with anchoring lugs. Also provide flanged frame for pre-finished or CMU walls.
3. FINISHED FLOORS: MiFab C1100-R-3-6 or Zurn Z-1440-VP floor cleanout with adjustable extension housing, cast iron ferrule with PVC plug (full size up to 4”), round scoriated stainless steel, secured, vandal-proof access cover and round frame. Provide top style compatible with floor type. Carpet: - carpet flange (carpet markers will not be acceptable); Terrazzo: - top with terrazzo recess.
4. OUTSIDE AREAS: Mi-Fab C1100-XR-4-6 or Zurn Z-1440-HD-VP extra heavy duty, vandal-proof ductile iron cover, cast iron ferrule for caulk, PVC plug (full size up to 4”) and positioning set screws.

END OF SECTION

SECTION 22 14 00

BUILDING STORM PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Piping shall be installed in a neat and orderly manner parallel to building coordinates with vertical drops. Piping shown underground shall be buried a minimum of 12 inches to top of pipe. Piping in the vicinity of equipment shall not interfere with access panels and maintenance space.

B. Piping shall be concealed in walls, chases and above ceilings except in mechanical equipment areas.

PART 2 - MATERIALS

2.1 STORM DRAINAGE, INSIDE BUILDING

A. GENERAL: Provide roof drains, flashings and piping extending from drains to five feet outside of building. Cast iron pipe shall be manufactured by Charlotte or Tyler Pipe. All piping shall comply with ASTM D1785/D2665.

B. MATERIALS:
1. ABOVE SLAB: Standard weight, bell and spigot cast iron, per ASTM A-74, with Ty-Seal joints. No hub piping with heavy weight, medium duty no-hub clamps may be used on piping 10” and smaller if proper pipe supports are installed to maintain uniform slope and rigidity. Piping above inaccessible ceilings shall be bell and spigot cast iron.
2. BELOW SLAB: Schedule 40 PVC

C. GASKETS: Hub and spigot gaskets shall be Tyler Ty-Seal, positive double seal compression type conforming to ASTM C564. No-hub joints shall be made with gasket and one piece stainless steel, heavy weight, medium duty no-hub clamps. Clamps shall be Mi-Fab Heavy Duty, Husky SD 2000, Clamp All Hi-Torque 80 or equal by Mission. No-hub clamps for pipes 6” and larger shall have 6 bands.

D. INSTALLATION: Continuously grade down in direction of flow 1/8" per foot. Piping below grade shall have maximum continuous slope consistent with the site conditions of existing mains to which they will be connected. When overflow drains are installed in the roof, the overflow drain body and the overflow ring piece shall have a fluorescent green paint mark visible from the roof so the roofer will be able to distinguish the overflow drains from the standard drains. This is to ensure the roofer slopes to the proper drain and reinstalls the overflow drain top to the correct body.

E. FINAL CLEANING: Hydroflush or rod out all sections of storm drain lines prior to substantial completion.

F. Refer to Architectural Drawings and Specifications for extension of drains.

2.2 STORM DRAINAGE, OUTSIDE BUILDING

A. GENERAL: Refer to Civil Engineering Drawings for location of storm inlets or junction boxes. Plumbing subcontractor shall extend building storm piping to the storm inlets that are provided by site subcontractor and make connection to inlet or junction box.

B. MATERIALS: SDR-26 PVC pipe in sizes through 12", and Schedule 40 PVC or standard weight cast iron with Ty-Seal joints for larger sizes. Cast iron pipe shall be manufactured by Charlotte or Tyler Pipe. All piping shall comply with ASTM D1785/D2665.

C. INSTALLATION: Continuously grade down in direction of flow 1/8" per foot. Piping below grade shall have maximum continuous slope consistent with the site conditions of mains to which they will be connected.

D. FINAL CLEANING: Hydroflush or rod out all sections of storm drain lines prior to substantial completion.

2.3 ROOF DRAINS

A. STANDARD ROOF DRAINS: Zurn Z-100-DP-DR Series or equal by Mi-Fab, adjustable cast iron roof drain with no hub connection. Provide heavy duty, vandal proof, galvanized, cast iron mushroom dome strainer and flashing rim with integral gravel stop, all secured with non-corrosive clamping units and vandal-proof locking mechanism that includes stainless steel, vandal proof hardware. Roof drains shall not have any gasket or other types of water sealing components below the roof flashing line. Where no-hub coupling at drain connection is not accessible due to roof thickness, provide deep sump roof drain to allow accessibility of coupling for maintenance purposes.

B. ACCESSORIES:
1. Series 1015 adjustable extension collar for insulated roof (where required)
2. Bearing pan and underdeck clamp
3. Vandal-proof, galvanized cast iron dome

END OF SECTION

SECTION 22 15 00

COMPRESSED AIR SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

F. Section 22 00 00 – General Plumbing Requirements

G. Section 22 00 10 – Closeout Requirements

H. Section 22 05 00 – Common Work Results for Plumbing

1.2 GENERAL REQUIREMENTS

A. Piping shall be installed in a neat and orderly manner parallel to building coordinates with vertical drops.

B. Piping shall be concealed in wall, chases and above ceilings except in the vicinity of equipment. All materials shall conform to the City Building Code.

C. Piping shall be sloped to prevent pockets. Slope toward equipment and provide dirt leg.

D. Piping in the vicinity of equipment shall be arranged to not interfere with access panels and maintenance space. Provide unions, flanges and shutoff valves to allow removal of the equipment and its subassemblies.

PART 2 - MATERIALS AND METHODS

2.1 COMPRESSED AIR PIPING

A. Schedule 40, Steel Pipe: ASTM A53/A53M, Type E or S, Grade B, black coated with ends threaded according to ASME B1.20.1.
   1. Steel Nipples: ASTM A733, made of ASTM A53/A53M or ASTM A106/A106M, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
   2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
   3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
   4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
   5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.

B. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel

C. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

D. Pipe identification shall comply with ASME A13.1. Pipe identification labels shall be located as follows:
   1. At intervals of not more than 6.1 m (20 feet).
   2. At least visible once in or above every room.
   3. On both sides of walls or partitions penetrated by the piping.
   4. At least once in every story height traversed by risers.

2.2 FLEXIBLE PIPE CONNECTORS

A. Stainless-steel hose flexible connectors shall be corrugated, stainless-steel tubing with stainless-steel wire braid covering and ends welded to inner tubing. The stainless-steel hose connectors shall be rated at 1380 kPa (200 psig) minimum. The end connections for 50 mm or DN50 (NPS 2 inches) and smaller shall be threaded steel pipe nipple. The end connections for 63 mm (NPS 2-1/2 inches) and larger shall be flanged steel nipple.

2.3 SPECIALTIES

A. Pressure Gauges: Pressure gauges permanently installed in the system or used for testing purposes shall be listed for compressed air service and shall include a snubber or pulsation dampener and an isolation valve for maintenance access.
   1. For line pressure use adjacent to source equipment: ASME B40.100, pressure gauge, single, size 4-1/2 inches, for compressed air, accurate to within two percent, with metal case. Range shall be two times operating pressure. Dial graduations and figures shall be black on a white background, or white on a black background. Gage shall be labeled for appropriate service and marked "USE NO OIL".
   2. For all services downstream of main shutoff valve: Manufactured for compressed air use and marked "USE NO OIL", 1-1/2 inch diameter gauge with dial range 1 to 100 psig for air service.

B. Air Pressure Regulating Valves:
   1. Air pressure regulating valves under NPS 3 inches shall be pilot or diaphragm operated, bronze body and trim, direct acting, spring loaded manual pressure setting adjustment and rated for 200 psig inlet pressure. Delivered pressure shall not vary more than one kPa for each 1.5 psig variation in inlet pressure.

C. Safety valves shall be constructed according to the ASME BPVC Section VIII and be National Board Certified, labeled, and factory sealed. The safety valve shall be constructed of bronze body with poppet type safety valve for compressed air service.

D. The automatic drain valves shall have stainless-steel body and internal parts rated for 200 psig minimum working pressure. The automatic drain valve shall be capable of automatic discharge of collected condensate.

E. The coalescing filter shall be capable of removing water and oil aerosols, efficiency of 99.9 percent retention of particles 0.3 micrometer and smaller, with color change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. The coalescing filter shall include mounting brackets for wall mount application.

F. Air line lubricators shall come with a drip chamber and sight dome for observing oil drop entering air stream. The air line lubricator shall have oil feed adjustment screw and quick release collar for easy bowl removal. The Air line lubricators shall include mounting brackets for wall mount application. Lubricators shall be suitable for 200 psig at 160 degrees F.

2.4 QUICK CONNECT COUPLINGS

A. The quick connect coupling assemblies shall have a locking mechanism constructed to permit one-handed feature for quick connection and disconnection of compressed air hose and equipment.

B. Automatic shutoff quick couplings shall be straight through brass body with O-ring or gasket seal and stainless-steel or nickel plated steel operating parts. The automatic shutoff quick connect coupling shall consist of socket or plug ends with one way valve and with barbed outlet or threaded hose fittings for attaching hose.

C. Valve less quick couplings shall be straight through brass body with O-ring or gasket seal and stainless-steel or nickel plated steel operating parts. The valve less quick connect coupling shall consist of socket or plug ends and with barbed outlet or threaded hose fittings for attaching hose.

2.5 HOSE ASSEMBLIES

A. Hose, clamps, couplings, splicers shall be suitable for compressed air service of nominal diameter indicated and rated for 300 psig minimum working pressure.

B. The hose shall be reinforced double wire braid, chloroprene reinforced covered hose.

C. Hose clamps shall be stainless-steel.

D. Hose couplings shall be two-piece straight through, threaded brass or stainless-steel O-ring or gasket seal swivel coupling with barbed ends for connecting two sections of hose.

E. Hose splicers shall be one piece, straight through brass or stainless-steel fitting with barbed ends.

2.6 OTHER PIPING ACCESSORIES

A. Reference Section 22 05 00 – Common Work Results for Plumbing, for requirements for valves, check valves, dielectric fittings and similar accessories.

2.7 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

A. System Design: Factory assembled automatic control system with load control and protection functions, mounted, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air

B. Control Panels: Shall comply with NEMA ICS 6, Type 12 and UL 508 labeled.
1. Enclosure: NEMA ICS 6, Type 12 control panel unless otherwise indicated.
2. Motor Controllers: Full-voltage, combination magnetic type with undervoltage protective feature and motor-circuit-protector-type disconnecting means and short-circuit protective device.
3. Control Voltage: 120-V ac or less, using integrated control power transformer.
4. Motor Overload Protection: Overload relay in each phase.
5. Starting Devices: Hands-off-automatic selector switch in cover of control panel, plus pilot device for automatic control.
6. Automatic control switches to alternate lead-lag compressors for duplex compressors.
7. Instrumentation: Include discharge-air pressure gauge, air-filter maintenance indicator, hour meter, compressor discharge-air and coolant temperature gauges, and control transformer.

C. Air Receiver: Horizontal air receiver, Steel tank constructed according to ASME BPVC Section VIII, Division 1.
1. Rated for minimum 175 psig design pressure and bearing appropriate code symbols. Including a sight gauge glass as well as a timed automatic solenoid drain valve.
2. Interior Finish: Corrosion-resistant coating.
3. Accessories: Include safety valve, pressure gauge, drain, pressure-reducing valve and three valve bypass on supply.

2.8 LUBRICATED, RECIPROCATING AIR COMPRESSORS

A. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.
1. Submerged gear-type oil pump.
2. Oil filter.
3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
4. Belt guard totally enclosing pulleys and belts.

2.9 INLET-AIR FILTERS

A. Description: Combination inlet-air filter-silencer, for each air compressor.
   1. Construction: Weatherproof housing for replaceable, dry-type filter element, with silencer tubes or other method of sound reduction.
   2. Capacity: Match capacity of air compressor, with filter having collection efficiency of 99 percent retention of particles larger than 10 micrometers/

2.10 REFRIGERANT COMPRESSED-AIR DRYERS

A. Description: Cycling, air-cooled, electric-motor-driven unit with steel enclosure and capability to deliver 35 degrees F, 100 psig air at dew point. Include automatic ejection of condensate from airstream, step-down transformers, disconnect switches, inlet and outlet pressure gauges, thermometers, automatic controls, and filters.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping shall be installed concealed from view and protected from physical contact unless indicated to be exposed. Piping shall be installed exposed in mechanical rooms and service areas.

B. All pipe shall be installed at right angles or parallel to building walls. Diagonal runs are prohibited unless indicated.

C. Piping shall be installed above accessible ceilings, allowing for sufficient space for ceiling panel removal and to coordinate with other services occupying that that space.

D. Piping installed adjacent to equipment shall be located to allow for the required service clearances.

E. Drain piping shall be installed with a 1 percent slope downward in direction of flow.

F. Nipples, flanges, unions, transitions, and special fittings, and valves shall be installed with pressure ratings same as or higher than system pressure rating.

G. Only eccentric reducers shall be installed where compressed air piping is reduced in direction of flow, with bottoms of both pipes and reducers fitting flush.

H. Branch connections shall be installed from the top of the main compressed air line. Drain legs and drain trap shall be installed at the end of each main and branch and at all low points in the system.

I. Thermometers and pressure gauges shall be installed on discharge piping from each air compressor and on each receiver.

J. Valves shall be installed to permit servicing to all equipment.

K. Pipes shall be installed free of all sags and bends.

L. Rigidly support valves and other equipment to prevent strain on tube or joints.

M. Compressor assembly shall have an equipment identification nameplate and data in accordance with 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

N. Suitably brace piping against sway and vibration. Bracing shall consist of brackets, anchor chairs, rods, and structural steel for vibration isolation.

3.2 PRELIMINARY STAGE TESTS

A. Preliminary tests shall be performed by the contractor prior to testing witnessed by the EOR. Tests shall be pneumatic and shall use dry, oil-free compressed air, carbon dioxide or nitrogen in metallic systems.

B. Testing of any system for any purpose shall include preliminary testing by swabbing joints under test with standard soap solution and observing for bubbles at internal pressures not in excess of 5 psig.

C. When testing reveals system leakage, isolate and repair the leaks, replace defective materials where necessary, and retest the system until there is no loss of pressure. Remake leaking gaskets with new gaskets and new flange bolting, and discard used bolting and gaskets.

D. Drainage piping shall be hydrostatically tested to a pressure of 5 psig to ensure the piping does not leak. Repair all observed leaks and retest until all leaks have been corrected.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part. Tests shall be pneumatic and shall use dry, oil-free compressed air, carbon dioxide or nitrogen in metallic systems.

B. The tests shall include initial piping purge test, initial pneumatic test for positive–pressure gas systems, initial cross-connection test, and initial standing positive-pressure gas piping tests, system capacity, control function, and alarm functions.

C. Pneumatic tests shall be performed utilizing a test pressure of 50 psig higher than the MAWP, minimum of 150 psi. Test pressure shall be maintained for a minimum period of four hours to ensure the temperature in the piping system stabilizes, then the pressure is refreshed and held for two hours with no loss of pressure. Pneumatic testing performance shall be in accordance with industry safety standards with the pressure gradually increased in increments of 25 percent of the MAWP until the required test pressure is reached. At each interval, the system pressure shall be held long enough for piping strains to stabilize. If leaks are observed, the leaks shall be identified, the system de-pressurized and repairs made before proceeding.

D. Other than standard piping flanges, plugs, caps and valves, only use commercially manufactured expandable elastomer plugs for sealing off piping for test purposes. Published safe test pressure rating of any plug used shall be not less than three times the actual test pressure being applied. During pneumatic testing evacuate personnel from areas where plugs are used.

E. Remove components that could be damaged by test pressure from piping systems to be tested.

F. Perform valve-operating tests and drainage tests to ensure valves do not leak when operating under pressure and are correctly labeled.

G. Check piping system components, such as valves, for proper operation under system test pressure.

H. Duration of a test will be determined by the EOR and will be for a minimum of 15 minutes with a maximum of 24 hours. Test may be terminated by direction of the EOR at any point after it has been determined that the pressure leak test has been satisfied.

I. Prepare and maintain test records of all piping systems tests. Records shall show Owner and Contractor test personnel responsibilities, dates, test gauge identification numbers, ambient temperatures, pressure ranges, rates of pressure drop, and leakage rates.

J. System verification and final testing shall be conducted comprising of a system verifier standing pressure test, verifier final tie-in test, verifier operational pressure test, labeling, and source equipment verification test.

K. When any defects are detected, correct defects and repeat test at no additional cost or time to the Owner. When testing reveals system leakage, isolate and repair the leaks, replace defective materials where necessary, and retest the system until there is no loss of pressure. Remake leaking gaskets with new gaskets and new flange bolting, and discard used bolting and gaskets.

L. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the EOR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.4 COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

Components provided under this section of the specification will be tested as part of a larger system.

END OF SECTION

SECTION 22 16 00

BUILDING NATURAL GAS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Piping shall be installed in a neat and orderly manner parallel to building coordinates with vertical drops.

B. Piping shall be concealed in wall, chases and above ceilings except in the vicinity of equipment. All materials shall conform to the City Building Code.

C. Piping shall be sloped to prevent pockets. Slope toward equipment and provide dirt leg.

D. Piping in the vicinity of equipment shall be arranged to not interfere with access panels and maintenance space. Provide unions, flanges and shutoff valves to allow removal of the equipment and its subassemblies.

E. Piping shown underground shall be buried a minimum of 30 inches to top of pipe. All below grade non-metallic, non-conducting pipe not under building slab shall have a tracer wire installed parallel to pipe. Tracer wire shall be a 14 gage, solid copper wire with PVC jacket with all joints and splices sealed water-tight. Carry end of wire up through slab and terminate in an accessible location. Provide identification label attached to wire.

F. All piping, fittings and valves shall be manufactured in the United States of America by National Tube, Republic and Youngstown.

G. The Building Automation Contractor may provide one or more gas meters to measure various building usages. Install where shown or where directed in the field. Refer to 23 09 23 Sequence of Operation for HVAC Controls for meters to be provided.

PART 2 - MATERIALS AND METHODS

2.1 NATURAL GAS, OUTSIDE BUILDING

A. GENERAL: Gas utility company will provide and install metering equipment for 5 psi service pressure. Extend piping from meter to building and install pressure reducing valve at building. Provide grounding per NFPA 70.

B. MATERIALS:

1. ABOVE GROUND: Schedule 40 black steel, ASTM ERW A-53, Grade B or ASTM A106, with malleable iron screw type fittings. Welded joints may be used for piping 2½" and larger.
2. BELOW GRADE: Polyethylene gas piping with socket weld connection, conforming to ASTM D2513, installed per manufacturer's requirements. Install minimum #14 copper wire in trench with pipe for locating purposes. Install X-Truecoat type schedule 40 steel pipe for the last five feet before exiting ground. Install dielectric union after piping exits the ground.

C. TEST TEES: Provide test tee in pipe at meter and on both sides of pressure reducing stations.

D. SLEEVES: Install pipe in vented sleeves when passing under roads, driveways, parking lots and similar areas. Sleeves shall be Schedule 40 PVC below grade and Schedule 40 galvanized steel otherwise. Install vent in a manner to prevent entry of rainwater, insects or foreign objects.

E. PAINTING: All exposed gas piping shall be painted with two coats of industrial grade, yellow epoxy paint.

F. ACCEPTABLE PIPE MANUFACTURERS: National Tube, Republic and Youngstown

2.2 NATURAL GAS, INSIDE BUILDING

A. GENERAL: Extend gas to all fixtures, appliances and equipment as required.

B. MATERIALS ABOVE GRADE: Schedule 40 black steel, ASTM ERW A-53, Grade B or ASTM A106. Joints may be welded or screwed, except that piping in inaccessible locations and all piping 2½" and larger shall be welded. Threaded nipples less than 1/2" shall be Schedule 80. All thread nipples are not allowed. All bolts, nuts and all thread used in the piping system and components shall be cadmium plated to resist rust. Final connections at low pressure appliances shall be corrugated flexible brass connections with epoxy coating, complying with ANSI ANS-Z21-24-1981, minimum pressure rating of 1/2 PSI. Science lab gas cocks shall be "hard piped" with schedule 40 black steel as specified above. Flex connections will not be accepted at gas cocks.

C. MATERIALS BELOW GRADE: Do not install piping below grade unless specifically shown on the Drawings.

D. INSTALLATION:
1. Do not install any gas piping in unventilated spaces including inside walls, unless totally encased with airtight sleeving. Sleeving shall be all metallic construction, welded or screwed black steel, Schedule 10 or heavier. Sleeves shall be vented as shown on the Drawings.
2. Provide an all brass lever handle gas cock in an accessible location branch line at each individual piece of gas consuming equipment.
3. Branch connections to gas consuming equipment shall be size indicated on the Drawings up to points immediately adjacent to equipment. Do not reduce to size of equipment until immediately adjacent to equipment.
4. All welded connections shall be made with bevel-ended pipe by certified welders.
5. All branch connections shall be made off the top of the main line.

E. PAINTING: All gas piping shall be painted with two coats of industrial grade, yellow epoxy paint.

F. ACCEPTABLE PIPE MANUFACTURERS: National Tube, Republic and Youngstown, or equal.

2.3 GAS PRESSURE REGULATORS:

A. Size for full connected load, with stop valves on both inlet and outlet connections.

B. Select orifices for inlet pressures established by the gas company serving the building, and for outlet pressures as required to serve the proper pressure at the items of equipment being supplied.

C. Outlet pressure shall be field adjustable.

D. Capacities as indicated in Schedule plus 10%.

E. Gas regulator shall be ANSI Z21.80 certified for line pressure regulation between the service regulator and connected equipment.

F. All gas regulators with inlet pressure above 2 psi shall be equipped with a factory installed overpressure protection device, as part of the ANSI Z21.80 certification.

G. Gas regulator shall be equipped with a vent limiting device, sized in accordance with the regulator outlet pressure.

H. All regulators installed outdoors shall be rated for outdoor installation.

I. Basis of design is the Maxitrol 325-L series of regulators

J. ACCEPTABLE MANUFACTURERS: Maxitrol, Pietro Fiorentini, or pre-approved equal.

END OF SECTION

SECTION 22 31 00

DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Provide all equipment, accessories and specialties indicated on the Contract Drawings, as specified, and as required under Section General Plumbing.

PART 2 - MATERIALS AND METHODS

2.1 WATER SOFTENING SYSTEM

A. GENERAL: Fully automatic softening system including one (2) softening tanks, one (1) salt storage tank, two (2) control valve assemblies, four (4) pressure gauges, two (2) flow sensors, two (2) controllers, interconnecting piping from control valves to tank, and control wiring. System shall be skid mounted, pre-piped and pre-wired.

B. SOFTENING TANKS: Each tank shall be 30 inches diameter, 54 inches straight side shell; designed for 100 PSIG working pressure, tested for 50% higher pressure: supported by strap steel legs: two 3” diameter handholes for tanks 30” diameter and smaller, or 11” X 15” manhole in top head and 2” resin removal plug in lower side shell for tanks over 30” diameter; each tank with 50% or more freeboard space. Internal piping shall be formed into a large radius 90-degree bend, one-piece top and bottom so there is no danger of failure and no exposed threads or flanges in the tank interior. Sandblast tank surfaces before finishing. Finish exterior surface with one coat of metal primer and 1.25-1.5 mils DFT of high solids polyurethane monochromatic gloss enamel. Finish interior surfaces with 8-10 mils DFT of epoxy phenolic amine cured formulation for cold water service, Plasite 9133 low VOC Epoxy.

C. SOFTENER CAPACITY: Reference plumbing schedule for softener capacity and performance requirements.

D. BRINE MAKER: Reference plumbing schedule for softener capacity and performance requirements.

E. CONTROL VALVES: Each softener shall have 2 inch Cast Iron Diaphragm valves with Victaulic end connections. The valves shall have an integral seat, and be fully lined with fusion bonded polyester. PVC or unlined metal valves are unacceptable. The valve shall be equipped with an automatic self-adjusting brine injector to draw brine. The injector shall be mounted on Victaulic connections and be able to be inspected, cleaned or replaced without removing any piping. Backwash control valve shall allow backwash and rinse rates at a constant rate regardless of water pressure in the 30 to 100 psig range. Each valve shall have inlet and outlet water sampling cocks and pressure gauges.

F. CONTROLS
1. The control shall have adjustable duration of the various steps in regeneration and allow for push button start, and provide for complete manual operation. The controller shall also allow on-line monitoring.
2. Regeneration shall be initiated by an insertion type pulse generator and an installation fitting (tee/saddle) compatible with the specified piping to house the sensor providing ease of removal for inspection without disruption of the piping system. A 25-foot cable shall be provided for direct connection to the electronic control device. A low voltage signal output from the flow sensor shall transmit flow rate and volume totalization data directly to the electronic water treatment controller. Accuracy shall be □1% over the full range and repeatable to □5% of full range.
3. A fully integrated factory mounted programmable microprocessor driven Electronic Water Treatment Controller with integral multi-ported pilot control valve shall be provided to initiate a backwash/regeneration sequence based on an external signal/batching devise. The rotary pilot control valve shall be factory pre-tubed to the operating valves. The same controller shall sequence the steps of regeneration and return to a service or standby mode. The initiating time and volume set points shall reset upon regeneration of the system. Power supply for the controller shall be 24 volts with a 110V/24V transformer provided.

G. PIPING: No additional face piping shall be necessary. The entire harness shall consist of copper piping with Victaulic fittings. All connection including the connections to the tank shall be Victaulic.

H. WATER TEST SET: Furnish to Owner at completion

I. SALT: Provide initial supply of 1250 pounds of food grade salt cubettes.

J. PERFORMANCE GUARANTEE:
1. Under actual operating conditions effluent shall contain zero gpg hardness as determined by soap test.
2. Loss of mineral through attrition during first three years of operation shall not exceed 3% per year.
3. Mineral shall not be washed out of system during service run or backwashing period.
4. Turbidity of effluent shall not be greater than incoming water.

K. INSTRUCTION AND START-UP: Provide booklet of operating and maintenance instructions, and one eight hour day start-up time by manufacturer'' factory representative.

L. ACCEPTABLE SUPPLIER:
1. Watertech Services
2. Mueller

END OF SECTION

SECTION 22 33 00

ELECTRIC DOMESTIC WATER HEATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Provide all equipment, accessories and specialties indicated on the Contract Drawings, as specified, and as required under Section General Plumbing.

B. Heaters shall have three year commercial warranty.

1.3 TEMPERATURE AND PRESSURE RELIEF VALVES:

A. GENERAL: Provide ASME rated, AGA certified and CGA listed for each water heater.

B. REQUIREMENTS: Select valve with the AGA-CGA rating equal to or greater than the input of the heater. Heaters with ASME constructed and labeled vessels, may use the ASME rating equal to or greater than the input to the heater, 1" minimum size. Valves shall be automatic re-seating type similar to Watts 40XL with test lever and extension bulb thermostat.

C. ACCEPTABLE MANUFACTURERS: Cash, McDonnell-Miller and Watts

PART 2 - EQUIPMENT

2.1 ELECTRIC WATER HEATER

A. DESCRIPTION: Glass lined tank, 2" fiberglass tank insulation with enameled steel jacket, three year commercial warranty (tank and parts), magnesium anode rods, ASME labeled T & P relief valve pipe to drain, vacuum breaker on inlet, adjustable controller and high limit safeties.

B. ELECTRICAL ELEMENTS: Shall have two non-simultaneous elements, built-in fusing and disconnecting means, U. L. listed. Provide proper voltage and rating as scheduled on the Drawings.

C. ACCEPTABLE MANUFACTURER: A. O. Smith, Bradford White, Rheem/Ruud or State

END OF SECTION

SECTION 22 34 00

FUEL FIRED DOMESTIC WATER HEATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Provide all equipment, accessories and specialties indicated on the Contract Drawings, as specified, and as required under Section General Plumbing.

1.3 PRESSURE AND TEMPERATURE RELIEF VALVES:

A. GENERAL: Provide ASME rated, AGA certified and CGA listed for each water heater.

B. REQUIREMENTS: Select valve with the AGA-CGA rating equal to or greater than the input of the heater. Heaters with ASME constructed and labeled vessels, may use the ASME rating equal to or greater than the input to the heater, 1" minimum size. Valves shall be automatic re-seating type similar to Watts 40XL with test lever and extension bulb thermostat.

C. ACCEPTABLE MANUFACTURERS: Cash, McDonnell-Miller and Watts

1.4 CO MONITOR

A. GENERAL: Provide a CO monitor for each room where gas fired water heaters are installed.

B. REQUIREMENTS: Monitor shall comply with NFPA requirements and disable heaters within the same room and provide audible alarm. Interconnect sensor to each heater and provide expanders as necessary.

C. MANUFACTURER: US Draft Co Model CGM-505

PART 2 - EQUIPMENT

2.1 HOT WATER STORAGE TANK

A. GENERAL: Storage Tanks shall be a vertical Lochinvar Lock-Temp “Energy Saver“ tank having a storage capacity as specified on the Drawings. The tanks shall be constructed with an inner chamber designed to receive all circulation to and from the water heater to eliminate turbulence in the tank. The baffled tank shall supply 80% of tank capacity without a decrease in outlet temperature, regardless of rate of draw.

B. CONSTRUCTION: Storage tanks shall be constructed in accordance with ASME - stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors. The jacket and tank base shall be a water tight construction and a built-in drain pan, complete with a 3/4” drain connection. Storage

tanks shall have a working pressure of 125PSI. Storage tanks shall be glass lined and fired to 1600 degrees F, and carry a five (5) year warranty.

C. INSULATION: Storage tanks shall be completely encased in high density fiberglass insulation of sufficient thickness to meet the energy efficiency requirements of the latest edition of the ASHRAE 90.1 Standard.

D. FINISH: The Lock-Temp Tank shall be furnished with a factory installed jacket of 16GA steel, galvanized inside and out and finished with three coats of acrylic enamel.

E. WARRANTY: Tank shall have five-year commercial warranty.

F. ACCEPTABLE MANUFACTURERS: Lochinvar or equal.

2.2 INDOOR TANKLESS GAS WATER HEATERS.

A. General: ANSI Z21.10.3/CSA 4.3 for gas-fired, hybrid, domestic-water heaters for indoor application.
1. Basis of Design Product: Navien NPE, Model 150S2.
2. Uniform Energy Factor: 0.93.
3. Minimum Temperature Setting Range: 100 to 140 degrees F.
4. Fuel: Natural Gas
   a. Gas Consumption: Reference Schedule.
   b. Gas Supply Pressure:
      1) Natural Gas: 3.5 to 10.5 inches of water column.
5. Electrical: Provide 120 V/60 Hz AC power source
6. Pressure Rating: 150 psi
7. Heat Exchanger: Dual, stainless steel heat exchangers.
8. Freeze Protection: For ambient temperatures as low as –5°F.

B. MANUFACTURERS
1. Provide products by one of the following manufacturers subject to compliance with the requirements below:
   a. Navien Inc
   b. Noritz

C. System Requirements
1. General: Provide tankless condensing water heater with microprocessor control and a direct electronic ignition system (with no standing pilot), fully modulating gas control valve, turbine flow meter, automatic electro-mechanical water flow control valve, and water temperature thermistors to maintain outlet water temperature between ± 2°F of set point temperature. Microprocessor shall have built in recirculation logic to control a pump’s heating cycles.
2. Controls: Provide an integrated temperature thermostat with an adjustable set point range of 100°F to 140°F.
3. Error Memory: Provide water heater with diagnostic maintenance codes that can be read via the display on the heater interface panel.
4. Emissions: Provide water heater that produces no more than 20 ppm NOx emissions when tested in accordance with the rules and regulations of the South Coast Air Quality Management District.
5. Burners: Provide tankless water heater with downward fired fiber mesh burners, solid brass water flow control valve, and solid brass inlet and outlet water connections.
6. Junction Box: Provide pre-installed electrical junction box.
7. Heat Exchanger Construction: stainless steel.

D. ACCESSORIES
1. Venting System: Exhaust manifold shall be a Category IV listed polypropylene vent system with horizontal or vertical termination.
2. Exhaust damper: provide common vent system with dampers that allows venting without check valves.

E. WARRANTY
1. Manufacturer’s Warranty: Manufacturer agrees to replace products that fail within the specified warranty period.
   a. Failure Methods: Condensate corrosion, thermal stress, mechanical defects, or workmanship.

b. Heat Exchanger: 8 years from date of Substantial Completion under standard or controlled regulation in commercial application.
c. All Other Parts and Components: 5 years from date of Substantial completion in commercial application.

END OF SECTION

SECTION 22 42 00

COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Provide all fixtures, drains, equipment, accessories and specialties indicated on the Contract Drawings, as specified, and as required under Section General Plumbing.

B. All fixtures and equipment shall be constructed of materials that are non-hazardous to the user.

C. Faucets, shower heads, shower valves and similar items shall have chrome plated brass handles, spouts, plates and trim.

D. Include all necessary accessories and trim pieces such as escutcheons, traps, supply tubing, stop and basin cocks, etc. All brass piping shall be seamless brass tubing. Fittings shall be heavy cast brass. Nipples shall be extra heavy. All exposed pipe shall be chrome plated.

E. All flush valves shall have screwdriver angle stops with cap covers, vacuum breakers and be chrome plated.

F. P-traps shall be chrome plated, cast brass body, adjustable type with bottom cleanout plug and 17 gauge tubing outlet with wall flange.

G. Provide 1/2" x 3/8" angle valve, loose key, supply stops with flexible supply risers for fixtures. Provide Marvel mechanical coupling for connection to copper piping.

H. Handicap fixtures shall have handicap compatible trim including stops and supplies, drains and valves. Provide Truebro Handi Lav-Guard vandal proof insulation kit over p-trap supplies and all sharp edges. Prowrap by McGuire or Trap Wrap by Brocar Products, Inc., will also be acceptable. Controls for flush valves shall be mounted on the wide side of toilet areas as required by the handicap codes.

I. Install Symmons 8-210-CK mixing valve on HW supply side of all lavatories and sinks, including fixtures not provided by Plumbing Contractor (i.e. lab sinks, kitchen faucets, etc.). Refer to Plumbing Drawings.

J. Where loose key stops are installed, provide stop key for each valve up to a maximum of 10 keys. Similarly provide up to 10 keys for wall hydrants and hose bibbs requiring a key to operate.

1.3 ROUGH-INS AND CONNECTIONS

A. SPECIAL FIXTURES AND TRIM: Provide rough-ins and connections to cabinet sinks and all trim where shown on the Drawings. Fixtures and trim requiring rough-ins and connections will be furnished loose under the special equipment section of those specifications, installation shall be under this Section. Refer to Architectural Specifications for information on prefab cabinets. Provide stops, risers and P-traps under this Section for prefab cabinets and kitchen equipment provided under the Architectural Specifications.

B. COORDINATION: The piping and connections for these areas have been indicated approximately. The exact arrangements and locations of various piping and connections shall be determined by shop drawings provided under other sections of these Specifications.

1.4 ACCEPTABLE MANUFACTURERS

A. WATER CLOSETS, LAVATORIES AND URINALS: American Standard, Eljer, Crane or Toto.
1. All water closets must be rated for 750lb static load.

B. SINKS AND SERVICE SINKS: Elkay or Just

C. MOP BASINS: Fiat or Sterns Williams

D. DRINKING FOUNTAINS: Elkay, Halsey-Taylor or Oasis with mechanical supply actuation

E. TOILET SEATS: Bemis 1655-C/SS with stainless steel, self-sustaining check hinge or equal by Church, Beneke, Olsonite or Centoco

F. FAUCETS: Chicago, Symmons, T&S Brass

G. METERING FAUCETS: Chicago, Symmons, T&S Brass

H. ELECTRONIC FAUCETS: NOT ALLOWED

I. MANUAL FLUSH VALVES: Sloan Royal, Zurn Aquavantage Plus or Toto

J. ELECTRONIC FLUSH VALVES: NOT ALLOWED

K. FIXTURE STOPS, P-TRAPS AND RISERS: Eljer, McGuire or Chicago

L. CARRIERS: All carriers shall have a minimum 750lb load rating; Josam, JR Smith, Wade, Mi-Fab or Zurn

M. WASH FOUNTAINS: Acorn or Bradley

N. THERMOSTATIC MIXING VALVES: Lawler, Symmons, Leonard

O. INDIVIDUAL SHOWER VALVES: Bradley Equaflo-HD, Symmons Safetymix

P. COLUMN SHOWERS: Acorn or Bradley

Q. EMERGENCY SHOWER/EYE-WASH: Bradley

PART 2 - MATERIALS AND METHODS

2.1 FIXTURE SUPPORTS

A. GENERAL:
1. Provide fixture supports for all water closets, lavatories, urinals, drinking fountains and other wall hung fixtures.
2. All foot supports on all types of fixture supports shall be the type that does not extend out from under the wall on which the fixture is mounted.
3. Construction and installation of the supports shall be as required to suit the job conditions, the space available, and the riser diagrams and details on the Drawings.

B. CARRIERS:
1. WATER CLOSET CARRIER: JR Smith 0211Y-M54-XX and similar shallow rough-in, heavy duty (750lb load rating) adjustable, horizontal or vertical closet carrier as required by waste piping. Provide hanger-rod support feet for carriers that span wide chases. Provide flush valve support with all water closet carriers.
2. LAVATORY CARRIER: JR Smith 0710 with concealed arms.
3. URINAL CARRIER: JR Smith 0617 with hanger and bearing plate.
4. ELECTRIC DRINKING FOUNTAIN AND BUBBLER CARRIERS: : JR Smith 0617 with hanger and bearing plate.
5. EYEWASH: : JR Smith 0617 with hanger and bearing plate.
6. SERVICE SINK: : JR Smith 0617 with hanger and bearing plate.

2.2 PLASTER TRAPS

A. Provide Mi-Fab MI-SOLID-SA-6 Series cast iron solids interceptor for sinks scheduled to have a plaster trap. Install to allow removal of bucket and to meet all ADA/TAS clearance requirements. No substitutions.

2.3 THERMOSTATIC MIXING VALVE FOR GANG SHOWERS

A. GENERAL:
1. Valves shall mix hot and cold water to deliver a preset constant outlet temperature of 105° F when supplied with 140° F hot water and 70° F cold water. Accuracy of ± 2° F at 75% drop in inlet pressures.
2. Designed and constructed so that failure of cold water supply instantly shuts off hot water supply, failure of hot water instantly shuts off cold water, and failure of thermostatic element will shut off both hot and cold water.
3. Entire assembly shall be factory piped and tested. It shall have the capacity to deliver scheduled gpm of tempered water at scheduled pressure drop through valve. Refer to Drawings.

B. COMPONENTS:
1. Bellows or Bi-metallic type thermostatic actuator.
2. Dial stem thermometer on outlet, range 0-200° F.
3. Pressure regulating valve with dial stem pressure gages.
4. Outlet ball valve shutoffs on each mixing valve.
5. Union end angle stops with checks and strainers.
6. Adjustable high temperature limit stop.
7. Outlet temperature adjustment knob with vandal proof screws on all mixing valves in each system.
8. Top inlets and outlet.
9. Fittings and piping as required for a complete cabinet installation with 16 gauge, painted enamel steel, surface mounted cabinet with 12 gauge steel door and mounting flange with chromed key lock (all keyed alike).
10. Minimum 1/2 GPM flow requirement.

C. Piping and components inside surface mounted steel cabinet shall have standard brass finish.

D. Locate cabinets as shown on the Drawings.

E. MANUFACTURER: Lawler, Leonard or Symmons

2.4 FIXTURES

A. See Drawings.

END OF SECTION

SECTION 22 47 00

DRINKING FOUNTAINS AND COOLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 22, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 22 00 00.

1.2 GENERAL REQUIREMENTS

A. Provide all fixtures indicated on the Contract Drawings, as specified, and as required under Section General Plumbing.

B. All fixtures and equipment shall be constructed of materials that are non-hazardous to the user.

C. Include all necessary accessories and trim pieces such as escutcheons, traps, supply tubing, stop and basin cocks, etc. All brass piping shall be seamless brass tubing. Fittings shall be heavy cast brass. Nipples shall be extra heavy. All exposed pipe shall be chrome plated.

D. Operating control shall be front and side rectangular pads.

E. Fixtures and equipment shall be delivered to the building properly crated and in perfect condition.

F. In addition to the manufacturers listed, equipment of identical design, quality and appearance will be considered when of the following manufacture:
   1. DRINKING FOUNTAINS: Elkay, Halsey-Taylor or Oasis

PART 2 - MATERIALS AND METHODS

2.1 EQUIPMENT

A. See Drawings.

END OF SECTION

SECTION 23 00 00

GENERAL HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

1.2 INTENT OF DRAWINGS AND SPECIFICATIONS

A. GENERAL: Drawings and Specifications are intended to be complimentary. Any work described in either of them, will be work required under this contract. Where there is a conflict between the Drawings and Specifications it shall be clarified by Request For Information (RFI). Barring clarification prior to bidding, the most expensive option shall be included. Clarification shall be made during construction. Should any work required by the drawings and specifications be in violation of any Federal, State, County or City laws, ordinance or regulation, those laws and regulations shall prevail, and shall be complied with by the Contractor as a part of this work with no extra compensation.

B. DRAWINGS: The drawings are schematic in nature. They are intended to show the various components of the system approximately to scale and indicate how they are to be integrated with other parts of the building. Determine exact component locations through coordination with the Owner’s Representative, job measurements, the requirements of the other trades, and all contract documents. The Drawings indicate general routing of the various parts of the systems, but do not indicate all fittings and offsets that may be required to fit the system into spaces allotted for them. The Contract shall include these items as required for a complete installation.

C. BASIS OF DESIGN: Scheduled equipment is the basis of design and has been coordinated for space, installation, and electrical requirements. Equipment and models from other acceptable manufacturers have not been verified or coordinated. Contractors who use other equipment in their bid shall verify space, installation, and electrical requirements prior to bidding and include any additional costs for installation of the substitute equipment.

1.3 MATERIALS

A. GENERAL: Manufacturer's printed directions shall be followed for preparing, assembling, installing, erecting, and cleaning manufactured materials or equipment, unless otherwise directed. Materials, when not otherwise definitely specified, shall conform to applicable National Specifications and Standards. All materials shall be certified to not contain any asbestos or other material banned by the Environmental Protection Agency. Lead shall not be used in any material, pipe, or solder in contact with the domestic water system.

B. SUBSTITUTION: The names of manufacturers and model numbers have been used in the Contract Documents to establish the type of equipment and standard of quality. Where only one name is mentioned for a particular item of material, then that manufacturer is the only one acceptable. Where several names are mentioned, any one of those listed may be furnished provided submittal contains sufficient information to show complete compliance with the Contract Documents. No attempt has been made to determine if each manufacturer listed will produce material that will comply with all requirements of this project or will fit the allotted space.

C. SUBSTITUTION REQUIREMENTS: Requests for substitution during the bidding period, in accordance with the requirements of the Special Conditions, must be accompanied by a complete product submittal with all features, accessories, and capacities noted. Large equipment must include a drawing (to scale) showing how the equipment and required access space will fit the available space. Acceptance for bidding does not waive the post bidding requirement for formal submittal and approval.

1.4 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. ELECTRICAL: Power wiring is specified in the Electrical Section. Interlock and control wiring (any voltage) is specified under this Section. Controllers and starters, unless part of a motor control center, are specified under this Section.

B. PAINTING OF EQUIPMENT, PIPING AND ACCESSORIES: Painting Section. However, all items furnished under this Section shall be kept clean and free from corrosion.

C. OPENINGS: Various other sections. The locations of all inserts and openings shall be determined under this Section and coordinated with the other Sections in ample time to avoid cutting new construction.

D. EQUIPMENT AND PIPING SUPPORT REQUIREMENTS: Refer to structural drawings, details and notes for specific equipment support and pipe hanging requirements. Specific loading and attachment methods shall be followed to assure that individual structural members are not overloaded.

1.5 ALTERNATES

A. GENERAL: Determine the scope of each specified alternate proposal by carefully reading all Divisions of the Documents. The Bid Form contains information explaining the extent of the construction to be performed under a specific alternate. Alternate proposals, which are not predominantly mechanical in scope, are described in other Divisions of these Documents. Pay particular note to re-roofing items that may necessitate adjustments to existing piping.

1.6 PERMIT, FEES AND APPROVALS

A. The contractor shall obtain and pay for all permits and fees to perform their work. They shall comply with all laws, ordinances, rules, and regulations bearing on the conduct of the work specified or shown on the drawings. This applies to Federal, State and Local Codes and Requirements. Approval from the various insuring and inspection authorities shall also be obtained. Refer to Architectural sections for additional information.

1.7 VISITING THE SITE

A. The Contractor shall be familiar with the Drawings and Specifications and shall have examined the premises and understand the conditions under which they will be obligated to operate in performing the contract. No additional compensation shall be allowed for failure to fully understand the requirements.

1.8 GUARANTEE

A. All materials, apparatus, and equipment furnished and installed under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner unless noted to have extended warranties.

1.9 NOISE AND VIBRATIONS

A. The Contractor shall guarantee that the entire system and its component items of equipment, as installed by them, shall operate without objectionable vibration or noises, as determined by the Architect. Carefully fabricate ductwork and fittings with smooth interior finish to prevent turbulence and generation or regeneration of noise. If, in the opinion of the Architect, objectionable vibration or transmission thereof to the building occurs, the Contractor shall execute such remedial measures as are necessary to eliminate such unsatisfactory operating conditions and the material and labor thereby required shall be performed at the Contractor's expense.

1.10 INSTALLATION REQUIREMENTS

A. COORDINATION: The Contractor shall cooperate with other trades on the job and make installations in the proper sequence during the construction of the buildings, and they shall notify the Architect well in advance of construction of all interference of their work with that of other trades and of building construction. This notification shall not relieve the contractor of their responsibilities to coordinate his work with the total project.

B. WORKMANSHIP: All work shall be performed in a neat skillful manner and in the best practice of the trade. Only workers skilled in the trades shall be employed to perform the work included in these specifications.

C. CLEAN-UP: Keep area of operations free from accumulation of waste material or rubbish at all times. All piping above accessible ceilings shall be cleaned of cement, plaster, and other construction debris prior to being concealed. The parts of the Mechanical installation which are to be painted or insulated shall be

thoroughly cleaned of cement, plaster, grease, oil spots, and other materials in preparation for painting or insulating.

D. EQUIPMENT PROTECTION: Do not deliver equipment to jobsite until it is actually needed for installation. Protect equipment from damage due to construction activities and the weather. Equipment allowed to stand in weather will be rejected and Contractor is obligated to furnish new equipment at no cost to Owner.

E. CUTTING AND PATCHING: Coordinate the work with other trades to arrange for all holes, chases, and other spaces necessary for the installation of all components of the mechanical systems. Inform the other trades in ample time for these to be provided. Where concrete flooring or paving must be cut to install MEP systems, contractor shall take measures to prevent damaging existing underground services. Contractor shall X-ray the area to be saw cut to determine the existence of underground services. When saw cutting, limit the depth of the cut to less than the thickness of the concrete. Breakout the concrete manually with particular care in areas of possible underground services.

F. STRUCTURAL STEEL: All structural steel used for the purpose of fabricating equipment supports, pipe supports, pipe guides, pipe anchors and framing for large ducts and plenums, shall conform to ASTM Designation A-36. All steel used for these purposes shall be new, clean, straight, and galvanized.

G. CONCRETE PADS: All equipment mounted on the floor or outside at grade, including expansion tanks and pot feeder, shall have a concrete housekeeping pad. Concrete pads shall be sized for the equipment to be supplied. Pad shall exceed base dimensions by approximately 4" all around. Reinforce pads rebar including #4 bar around perimeter. Tool pad to form chamfered edge. Nominal pad thickness for air handlers and chillers shall be 6”. Nominal thickness shall be 4” for all other pieces of equipment. Refer to details for outdoor equipment.

H. ROOF MOUNTED EQUIPMENT SUPPORTS: For equipment mounted on the roof, provide curbs for air handling units, RTU’s, ERV’s, fans and similar equipment. Provide roof curbs and housing for duct and pipe penetrations of the roof. Provide Thycurb structural support rails for roof mounted condensing units, chillers, and similar equipment without large roof penetrations. Select rails for equipment size, weight and to span at least two roof joists per rail.

1.11 CLOSEOUT REQUIREMENTS

A. ENERGY MANAGEMENT SYSTEM: No portion of the total contract will be declared substantially complete until the automatic temperature controls for that portion has been demonstrated to be complete and functioning as intended. The temperature control system shall maintain all the space temperatures at plus or minus two degrees of set point.

B. AS-BUILT DRAWINGS: The Contractor shall obtain a set of project drawings and keep these at the jobsite during construction. During the course of construction, any changes made shall be marked on these drawings, particularly locations for those items which will need to be located for servicing. Upon completion of the job, mark each sheet "Record Drawings", date, and deliver to Architect.

C. OWNER’S INSTRUCTIONS: Provide the following periods of instruction to the Owner's designated personnel upon completion of the system's installation. Provide additional training as noted in individual equipment specifications.
   1. HVAC System - 8 Hours
   2. Temperature Controls Systems - 8 Hours

D. CLOSEOUT MANUALS: At completion of job, furnish three copies of spare parts lists and operating instructions for all equipment furnished under this Division. These lists and instructions shall be published by the manufacturer of the equipment. Bind in 3-ring binders with project name.

E. REFRIGERANT: Furnish and install full refrigerant and oil charge in the air conditioning refrigeration systems and maintain charge for full term of the guarantee.

F. LUBRICATION: After the installation is completed, lubricate all moving parts of all equipment furnished under this Division of the Specifications. Leave with the Owner a brief but complete set of lubrication instructions showing the recommended frequency of lubrication and the type of lubricant recommended for each piece of equipment.

G. SPARE PARTS: Upon completion of the installation, deliver to the Owner all tools and spare parts that are furnished by the Equipment Manufacturer for use with the equipment furnished under this Contract.

1.12 OPERATION TESTS AND ADJUSTMENTS

A. After completion of the work and before final acceptance thereof, the Contractor shall notify the Architect when he is ready for the balancing of air and hydronic systems which will be performed by a professional test and balance firm selected by the Owner as described in Section 23 05 93 – Test and Balance.

B. After completion of the work and before final acceptance thereof, the Contractor shall notify the Architect when he has balanced the air and hydronic systems to within ±10% of the scheduled values. Provide test report as described in Section 23 05 93 – Test and Balance.

1.13 SHOP DRAWINGS

A. All submittals shall be submitted in PDF form. Submittal will be reviewed with comments incorporated in this PDF. After final approval, Contractor shall provide a hard copy for use at the project site.

B. The purpose of these submittals is to attempt to aid the contractor in such a manner that improper or unacceptable materials are not delivered to or installed on the job. Shop drawings shall be approved before installation of the material under consideration. Approval of these submittals shall not be construed as releasing The Contractor from compliance with the Contract Documents. All materials and equipment shall be subject to final acceptance by the Engineer at completion of construction.

C. Shop Drawings shall consist of published ratings of capacity data, detailed construction drawings, wiring and control diagrams, performance curves, installation instructions, manufacturer's installation drawings and other pertinent data. Where the literature is submitted covering a group or series of comparable items, the item under consideration shall be clearly indicated. Ductwork shop drawings shall include one printed set of drawings in addition to the PDF. Drawings shall be submitted showing revisions to equipment layouts due to use of alternate or substitute equipment. The front sheet of each copy of the submittal shall have the following typed information:
   1. Job name and location.
   2. General Contractor's name, address, project manager's name and telephone number.
   3. Submitting Sub-contractor's name, address, project manager's name and telephone number.
   4. Suppliers company name, address, salesman's name, and telephone number.

D. Equipment that has regional representation shall only be supplied by the regional representative that serves the area where the project is located. The regional representative’s name and signature shall be included with the shop drawing.

E. Shop Drawings are required for but are not limited to the following items:
   1. Chillers
   2. Air Handling Units
   3. Heating Boilers
   4. DX Split Systems
   5. Particulate Air Filtration
   6. HVAC Pumps
   7. Fans & Roof Curbs
   8. VAV/CVT/VT/ET Boxes
   9. HVAC Ductwork & Casing
   10. Fabric Duct Sock
   11. Duct Accessories
   12. HVAC Insulation
   13. Air Devices
   14. HVAC Controls and Sequence of Operation
   15. Refrigerant Piping
   16. Hydronic Piping
   17. Hydronic Specialties
   18. Motor Starters
   19. Vibration Isolation
   20. Piping Materials
   21. DX Condensing Units
   22. Sound Attenuators
   23. Electric Duct Heaters

24. Pipe Markers
25. Roof Pipe Supports
26. Chilled Water Storage Tank
27. Unit Heaters
28. Condensers
29. Water Treatment
30. Ductwork Shop Drawings
31. 1/4” Scale Mechanical Room Drawings

F. Approval of these submittals shall not be construed as releasing the contractor from compliance with the contract Documents. They are a means of coordinating the work and aiding in the proper selection and installation of equipment. Do not release items such as fire dampers and starters until associated equipment or ductwork drawings are approved. All materials and equipment shall be subject to final acceptance by the Engineer at the completion of construction and adjustments of the system.

G. Major equipment in AHU/Mechanical Rooms will not be approved until contractor has submitted and received approved 1/4” scale coordination drawings of mechanical and air handling unit rooms showing sizes of proposed equipment, including access space, and plumbing, and electrical equipment also located in the room.

H. If a submittal is returned to the Contractor marked “Rejected” or “Revise and Resubmit,” only one (1) additional submittal will be permitted without the Contractor incurring charges for the additional re-submittals. SEG shall be reimbursed by the Contractor for any expense in connection with any necessary submission in addition to the two (2) submissions allowed. Contractor will be billed by SEG at a rate of $125/hr. for these occurrences.

1.14 SUBSTITUTIONS

A. The manufacturer names and model numbers have been used in the Contract Documents to establish types of equipment and standards of quality and are intended to be the Basis of Bid. No attempt has been made to determine if each manufacturer listed for a particular item of equipment will produce material that will comply with all requirements. If only one manufacturer is named for a specific item of equipment (except lighting fixtures), the specified manufacturer will be the only acceptable one. Where more than one manufacturer is named for a specific item of equipment, only one of these manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer as outlined in Special Conditions and this Article. If a submittal contains sufficient information to prove compliance with the Contract Documents, then that submittal will be acceptable.

B. All other brands, including any additional names which may be listed as “Alternates” or “Approved Equal” must conform with the specifications, size, accessories, etc. of the first named brand and be subject to Paragraph D and E of this Article. Alternate equipment must be equal from the standpoint of materials, construction, and performance. Request for substitution must be accompanied by complete data and descriptive sheets during the bidding period as described in Paragraph D and E of this Article.
   1. Submitted on Bidder’s letterhead attached to Proposal Form with individual deductive amounts stipulated and the documentation required in Paragraph E-03.
   2. All savings for Owner’s selection of deductive amounts by acceptance of alternate or substituted items are to be paid to the Owner.

C. All equipment within common group or category (e.g., switchgear, lighting fixtures, fire alarm, etc.) shall be same manufacturer.

D. Proposed Substitutions/Approved Equals:
   1. Submitted no less than 14 calendar days prior to bid date.
   2. Submit proposed substitutions with catalog data and/or manufacturer’s shop details indicating all modifications required to conform with specified brand. Include all relevant items necessary to determine equal status or submittal shall be deemed incomplete and rejected.
   3. If submittal contains sufficient information to prove compliance with the Contract Documents, then that alternate submittal will be acceptable. Approved submittals for bidding purposes only will be published by addenda.

E. 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-2.

2. Owner reserves the right to accept or reject any or all substitution proposals before execution of 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.

1.15 MECHANICAL INSPECTIONS

A. GENERAL: Contractor shall formally request inspections of any and all mechanical systems installations. Inspections shall include but not be limited to duct pressure tests, pipe tests, underground installations prior to backfill, rough-in installations, wall cover inspections, above ceiling inspections and final inspection.

B. Contractor shall provide a MINIMUM of 48-hour notice prior to requested inspection time, no exceptions.

C. INSPECTION REPORTS: After each inspection, the Engineer will generate an inspection report and distribute promptly. The Contractor will then be given 7 working days from date of report to address all deficiencies listed on the report. The General Contractor shall verify that all items on each inspection report have been addressed by their subcontractors in this time. Once verified the General Contractor shall sign-off on each deficiency listed on the report and return the signed-off copy of the inspection report to the Architect and Engineer via e-mail.

D. INSPECTION REPORTS: After each inspection, SEG will generate an inspection report and distribute promptly. The Contractor will then be given 7 working days from date of report to address all deficiencies listed on the report. The GENERAL CONTRACTOR shall verify that all items on each inspection report have been addressed by their subcontractors in this time frame. Once verified the GENERAL CONTRACTOR shall sign-off on each deficiency listed on the report and return the signed-off copy of the inspection report to SEG via e-mail. After the signed-off report is returned to SEG, the GENERAL CONTRACTOR shall request a re-inspection by SEG to close the report. If after 7 working days no re-inspection is requested by the GENERAL CONTRACTOR to close a report, SEG reserves the right to re-inspect whenever our schedule allows, with these re-inspections still being subject to Paragraph E below.

E. TEST REJECTIONS AND RE-INSPECTIONS: If a test is rejected or a re-inspection of an issued SEG Inspection Report is found to NOT be completely addressed, only ONE (1) additional inspection will be permitted without the Contractor incurring charges for each additional inspection required. SEG shall be reimbursed $500 by the GENERAL CONTRACTOR for expenses in connection with EACH inspection in addition to the two (2) inspections allowed.

1.16 COMMISSIONING AND TEST AND BALANCE

A. Third party commissioning and an independent test and balance contractor are a part of this project. Commissioning agent and T&B contractor will be under a separate contract directly with Owner. Refer to included specifications for commissioning and T&B.

B. Mechanical contractor shall complete the pre-function checklist for the various mechanical devices. Checklists will be supplied by the commissioning agent.

C. Mechanical contractor shall perform system tests as required by the commissioning agent in addition to any that are described in these specifications.

1.17 DEMOLITION AND REMODELING

A. In areas of demolition, contractor shall remove all HVAC equipment, ductwork, piping, and devices not to be reused. Any material that has salvage value shall be offered to the Owner, and if accepted, delivered to his warehouse. If not accepted, it shall be properly disposed of with the other construction debris.

B. Where existing systems serve other areas as well, they shall remain active in those areas. Cap, patch and relocate ducts and piping to keep systems operable.

C. General Contractor shall remove and replace ceilings, walls, floors, and other finishes as necessary to install or modify mechanical systems.

D. Where ceilings are to be removed or replaced, remove, and reinstall diffusers, grilles, or other existing mechanical devices.

E. Relocate ductwork and piping as necessary to allow new or modified construction. Repair existing mechanical systems damaged by construction activities.

F. Where existing starters are to be reused, install heaters with proper size for revised loads.

G. Where large equipment is to be replaced (chillers, boilers, air handling units, etc.), ensure that equipment submitted by acceptable manufacturer but is not the scheduled manufacturer will fit in the available space and can be installed through existing doors, louvers, or windows prior to using this equipment in the bid.

H. Where new chilled or heating water piping connects to the existing system, system may require partial or complete draining of water. Costs for shutdown, drainage, refilling with properly treated water, and restarting of the system shall be included in bid.

I. Where existing equipment is modified or replaced (MEP and Architectural) and interfaces with the Energy Management System, disconnect and reconnect EMS wiring, and replace sensors, as necessary.

J. Where existing equipment is replaced with new, reconfigure and extend as necessary, refrigerant, water and drain piping, and flues to accommodate the new equipment. Provide new shutoff valves for piping connections.

K. Provide multiple sets of air filters for all supply air handling equipment for use during construction. During construction provide an additional pre-filter consisting of roll filter media installed across the air intake of the air handling equipment. Replace overlay filter media and filters during construction as necessary to protect coils. Install a set of new filters prior to Testing and Balancing of the system. Provide a final set of new filters at Substantial Completion for Owners use, including installation when necessary.

1.18 EXCAVATIONS, TRENCHING, AND SHORING

A. GENERAL: The sides of all excavations for installation of underground piping shall be shored, sheeted, braced, sloped, or otherwise supported by means of sufficient strength to protect workers and other individuals within or near the excavation.

B. PREPARATION
1. Prior to opening any excavation, review the Site Survey provided by the Owner to determine the locations of existing underground utilities. Contact utility companies for additional information and marking of underground utilities. When underground piping is encountered, provide suitable supports to protect the existing piping and prevent injury to workers.
2. Prior to opening any excavation, locate and make safe any trees, boulders and other surface encumbrances that create a hazard to workers involved in the excavation work at any time during the operation.

C. SLOPING: The sides of trenches five feet or more in depth protected by sloping shall have an angle of repose of 1:1 (45°), or shallower if water conditions, silty materials, loose boulders, or areas where erosion and slide planes appear.

D. SHORING: The sides of trenches five feet to ten feet in depth and three feet wide protected by shoring, shall have shoring members with minimum size and maximum spacing as follows:

	TYPE	SIZE	SPACING
1.	Uprights	2" x 4"	Close sheeting
2.	Stringers	4" x 6"	4 feet
3.	Cross braces	4" x 4"	4 feet vertical
4.	Cross braces	4" x 4"	6 feet horizontal

5. Trenches from three to six feet wide shall have 4" x 6" cross braces.

E. MATERIALS: All materials shall be in good serviceable condition, sound, free from large or loose knots, and of proper dimensions.

F. MATERIAL STORAGE: All excavated material and shoring lumber shall be stored a minimum of two feet away from the edge of the excavation.

G. WEEP HOLES: Tight sheeting and sheet piling shall have sufficient weep holes and drains to eliminate ground water pressure on the sheeting.

H. SURFACE WATER: Diversion ditches, dikes, or other suitable means shall be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Water shall not be allowed to accumulate in an excavation.

I. MACHINERY: Do not operate machinery or place heavy objects adjacent to the excavation unless the shoring and bracing is strengthened to resist the extra pressure due to such superimposed loads.

J. BARRIERS: Trenches and other excavations left unattended shall have lighted barriers to mark their presence and prevent injury to workers and other people.

K. BRIDGES: Provide walkways and/or bridges with standard guard rails where workers or equipment are required or permitted to cross over trenches or other excavations.

L. EXITS: Where workers are required to be in trenches four or more feet deep, an adequate means of exit, such as a ladder or steps, shall be provided and located so as to require no more than 25 feet of lateral travel.

M. CODES: Additional requirements as listed in Chapter XVII of the Occupational Safety and Health Administration Code shall be complied with.

END OF SECTION

SECTION 23 00 10

MECHANICAL SYSTEMS CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

PART 2 - MATERIALS AND METHODS

2.1 CLOSEOUT REQUIREMENTS

A. ENERGY MANAGEMENT SYSTEM (EMS): No portion of the total contract will be declared substantially complete until the automatic temperature controls for that portion has been demonstrated to be complete and functioning as intended. The temperature control system shall maintain all of the space temperatures at plus or minus two degrees of set point.

B. AS-BUILT DRAWINGS: Obtain a set of project drawings and keep these at jobsite during construction. During the course of construction, mark on these prints any changes which are made, noting particularly locations for those items which will need to be located for servicing. At completion of job, mark each sheet "Record Drawings", date and deliver to Architect.

C. CLOSEOUT MANUALS: At completion of job, furnish three copies of spare parts lists and operating instructions for all equipment furnished under this Division. These lists and instructions shall be published by the manufacturer of the equipment. Bind in 3-ring binders with project name.

D. CLOSEOUT DOCUMENTS: Provide three printed copies of the approved submittal with wiring diagrams, sequences, floor plans and graphics updated to the final installation configuration.

E. REFRIGERANT: Furnish and install full refrigerant and oil charge in the air conditioning refrigeration systems and maintain it for full term of the guarantee.

F. LUBRICATION: After the installation is completed, lubricate all moving parts of all equipment furnished under this Division of the Specifications. Leave with the Owner a brief but complete set of lubrication instructions, showing the recommended frequency of lubrication and the type of lubricant recommended for each piece of equipment.

2.2 GUARANTEES AND WARRANTIES

A. GENERAL FOR MECHANICAL SYSTEMS: All materials, apparatus and equipment furnished and installed under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner unless noted to have extended warranties.

B. TEMPERATURE CONTROLS: The temperature control system and its proper operation shall be guaranteed for a period of one year after substantial completion and any control devices which prove to be defective during the guarantee period shall be repaired or replaced without cost to the Owner. After the initial warranty period, an additional twelve-month preventative maintenance contract shall be included in the base price of this Contract. This maintenance contract shall include quarterly preventive maintenance, all repair labor, parts and equipment. The system shall be warranted for parts and labor for a total of two years.

C. AIR COOLED CHILLERS: Provide a one-year warranty (parts and labor) for total unit. Provide a four-year extended warranty (second through fifth year) on the motor-compressor-drive assembly for parts and

labor, including refrigerant. All replacement parts shall be newly manufactured. For each chiller provide factory certificates listing chiller model, serial number and warranty information in the close out documents.

D. AIR COOLED CONDENSING UNITS: Provide five-year compressor warranty.

2.3 SPARE PARTS

A. GENERAL: Upon completion of the installation, deliver to the Owner all tools and spare parts that are furnished by the Equipment Manufacturer for use with the equipment furnished under this Contract.

B. FILTERS: Install a complete set of filters for all equipment at substantial completion.

2.4 TRAINING

A. GENERAL: Provide eight hours of instruction to the Owner's designated personnel upon completion of the building mechanical system's installation. Provide additional training for specific systems as noted in the following sections.

B. TEMPERATURE CONTROLS SYSTEM: Provide 8 hours of instructions on system operation to Owner's personnel during the closeout period of the project. Additionally, the contractor shall supply the Owner with a training DVD that will instruct the Owner’s personnel on recommended, detailed, maintenance procedures and troubleshooting of their equipment. Provide an additional 48 hours of instructions over a 3-year period for but not limited to operate interface program, software programming, system diagnostics, hardware installation and repair. No session to be more than 4 hours long with no limit on attendees. Technical support for 3 years over the phone shall be provided at no additional cost to the Owner. The Contractor shall be able to call and diagnose the system from his office.

END OF SECTION

SECTION 23 05 00

COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 CUTTING AND PATCHING

A. Coordinate the work with other trades to arrange for all openings, chases, and other spaces required for the installation of all the mechanical system's components. Inform the other trades in ample time for these to be provided. Failure to comply with this requirement may necessitate cutting and patching work. If such work becomes necessary, it will be done under this Section of the specifications, and shall conform to all applicable requirements of other Sections of the Specifications.

B. Where concrete flooring or paving must be cut to install MEP systems, contractor shall take measures to prevent damaging existing underground services. Contractor shall utilize ground penetrating radar and electrical circuit tracing equipment in the area to be saw cut to determine the existence of underground services. When saw cutting, limit the depth of the cut to less than the thickness of the concrete. Breakout the concrete manually with special care in areas of possible underground services.

2.2 PIPE SUPPORTS

A. GENERAL: Provide pipe supports and guides of size and type to support pipe as well as limit movement. Minimum size hanger rod shall be 3/8". Piping connected to a piece of equipment shall have a support located near enough to the equipment that there will be no pipe weight supported by the equipment. In no case shall the nearest support be more than two feet horizontally from the connection point. Pipe support material shall be selected to be compatible with the pipe material to prevent galvanic corrosion. Un-insulated copper piping shall be wrapped with gas wrap tape at each hanger (minimum 2" beyond hanger) and supports shall be hot dipped copper clad or plastic covered. Vertical copper piping shall have a minimum on one intermediate support if over five feet.

B. HORIZONTAL PIPING SUPPORT SPACING: As recommended by support manufacturer, but spaced not more than listed below:

	Pipe Size	Steel Pipe	Other Pipe
1.			
2.	1" & Smaller	6 Feet	4 Feet
3.	1¼" & 1½"	8 Feet	5 Feet
4.	2"	8 Feet	5 Feet
5.	2½" to 4"	8 Feet	6 Feet
6.	6" and Larger	8 Feet	6 Feet

C. SUPPORT FROM ABOVE: Support piping near roof or upper floor from structure if sufficient strength exists. Use a method suitable for type of construction and of sufficient strength. Use threaded steel hanger rods of diameter required to safely support loads. Minimum size hanger rod shall be 3/8". Install

rods through holes drilled in beam flanges, 1½" x 1½" x 8" angles welded to structural members or top cord slot at joist panel points and secure with large washers and nuts. Refer to structural drawing details for additional information. Hangers shall be manufactured by Grinnell or Tolco. Do not use perforated strap.

1. SINGLE RUNS OF PIPE, NO EXPANSION PROBLEM: Adjustable clevis type Grinnell Figure 260.
2. MULTIPLE RUNS: Trapeze hangers.
3. BEAM CLAMPS: Grinnell Figure 92 for smaller pipe
4. BEAM CLAMPS: Grinnell Figure 228 (storm or sanitary 8” and larger)

D. SUPPORT FROM BELOW: All piping near the floor, or where ceiling structure does not have sufficient strength, or where there is no ceiling shall be supported from below. Support members shall be steel pipe with base plates, or welded steel structure suitably braced.

E. SUPPORT MATERIAL FINISH: Galvanized or zinc plated steel. Provide hot dipped copper clad supports for copper piping.

F. PIPE SADDLES: Install 18 gauge, 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, 16” minimum length. Provide compressible gasketing between non-insulated plastic pipe and hangers. Provide insulating material between dissimilar metal.

2.3 ROOF MOUNTED EQUIPMENT SUPPORTS

A. GENERAL: Equipment mounted on the roof shall have supports consistent with the equipment size and weight, roof construction and flashing, and the structural design of the roof.

B. ROOF CURBS: Provide for roof mounted air handling units, DX rooftop units, fans, roof duct penetrations, roof pipe penetrations and similar equipment with roof penetration.

C. SUPPORT RAILS: Provide Thybar Corporation ThyCurb support rails to support roof mounted equipment that does not have roof penetrations under the equipment. This would include air cooled condensing units, condensers, and chillers. Provide also for roof piping and roof mounted ductwork if not noted to be on Portable Pipe Hanger Supports.

2.4 MOTORS

A. GENERAL: This section applies to motors larger than 1/2 horsepower and not part of an assembly. Select for starting torque and current, suitable to start and continuously run equipment served. Horsepower rating shown on Drawings are preferred, but motor must not be loaded more than 1.0 X nameplate horsepower. Provide larger motor if required to stay within this limitation and include all costs for any required increases in the electrical system. All motors shall have metallic nameplates marked with information required by NEC 430-7. Motors that are controlled by inverters shall be designed for this application.

B. ENCLOSURE: Open Drip Proof (ODP) for locations protected from the weather; Totally Enclosed Fan Cooled (TEFC) for exposure to weather or installed inside air handling units or serving pumps. Frame construction shall be steel or cast iron with all surfaces including air passages coated with a rust inhibiting primer and finished with an alkyd or epoxy enamel paint.

C. INSULATION: Class B for maximum 40° C ambient, Class F or H or higher.

D. EFFICIENCY: Motors shall be premium efficiency type and have all copper windings.

E. SERVICE FACTOR: 1.15.

F. ELECTRICAL CHARACTERISTICS: Provide nameplate ratings the same as circuit voltage indicated on the electrical drawings. Coordinate to give proper operation with starting equipment scheduled.

G. SINGLE PHASE MOTORS: Permanent Split Capacitor (PSC) start unless special load requires another type, resilient mounting, inherent overload protection and sealed bearings requiring no lubrication but with provisions for future lubrication.

H. THREE PHASE MOTORS: Ball bearings with grease lubrication fitting on top and drain on side or bottom. Provide sleeve bearings with oil cups for units requiring minimum noise level. Average bearing life shall be 150,000 hours.

I. ACCEPTABLE MANUFACTURERS: Allis-Chalmers, Baldor, Century, General Electric, Marathon, Reliance, Siemens, US Motors, and Westinghouse.

2.5 VALVE INSTALLATION

A. Ball and butterfly valves shall be installed such that handle for valve is positioned on the side of the pipe and is pulled down to close the valve. Provide access panels of adequate size for concealed valves. All valves above a ceiling shall be installed within 24” of the ceiling.

2.6 VALVE IDENTIFICATION

A. GENERAL: Each valve 2” and larger, except those located adjacent to the equipment they serve, shall have a tag of .050-inch-thick by 1½" diameter brass, stamped or engraved with the valve number and service symbol. Attach tag to the valve with stainless steel chain.

B. SCHEDULE: Furnish a valve schedule properly identifying the valve number and service with the exact location, the material within the pipe and the room numbers or area that the valve serves. Mark the symbol and number of all valves, exactly as the valves are tagged On the "As Built" Drawings. Provide one valve schedule, as above, installed in aluminum frame with plastic shield, and mount on wall of main equipment room.

C. CEILING IDENTIFICATION: For valves above accessible ceilings, glue red star on ceiling tee intersection nearest the valve location.

2.7 EQUIPMENT IDENTIFICATION

A. GENERAL: Each piece of mechanical equipment shall be suitably marked with the name as listed on the plans. Name shall be prominently displayed so it may be easily located and read after equipment installation. Pumps may be marked on adjacent piping. Provide lamacoid nameplate with minimum 1.5 inch letters.

B. The following equipment may be marked with decal or stencil painted, 3" high letters:
1. Air Handling Units
2. Rooftop Units
3. Energy Recovery Units
4. Condensing Units
5. Chillers
6. Boilers
7. Cooling Tower

C. The following equipment may be marked with decal or stencil painted, 2" high letters:
1. Fans
2. VAV/CVT Boxes
3. Dehumidifiers
4. Pumps

2.8 PIPE IDENTIFICATION

A. Identify all new and existing system piping. Use EMED Co. Kwik-Koil Pipe Markers of appropriate legend and background color, complete with direction arrow. Select appropriate size for diameter of the piping including insulation. Markers or arrows not wrapping the full circumference of the pipe shall be tie wrapped in place, otherwise taped at each end.

B. Apply markers as follows:
1. At input and output of each piece of equipment inside building.
2. At each valve not in a mechanical room.
3. At every point where a pipe enters or exits a wall or floor.
4. At intervals not exceeding 20 feet.

C. These markers shall conform to OSHA and ANSI A 13.1 Codes. Arrow markers must have same ANSI background colors as their companion pipe markers and wrap completely around pipe with 3” overlap.

D. Pipe markers and arrow markers shall be provided as follows:
1. Chilled Water Supply
2. Chilled Water Return
3. Heating Water Supply
4. Heating Water Return
5. Condenser Water Supply (inside building)
6. Condenser Water Return (inside building)

2.9 PIPE PAINTING

A. GENERAL: All piping or insulation on piping exposed to view shall be painted. Insulated pipe with required metal jacket shall not be painted.

B. PAINT TYPE: Industrial grade, high gloss enamel over suitable primer. Provide two finish coats.

C. COLOR CODING: (Verify with Architect prior to painting)

1. Condenser Water Piping	Beige
2. Chilled Water	Medium Blue
3. Heating Water	Maroon

2.10 ACCESS PANELS

A. REQUIRED: Panels of size and location to provide access to all concealed valves and equipment. Obtain Architect's approval of locations and type before ordering.

B. SIZE: Minimum 12" x 12", larger where required for adequate service access.

C. WALL MOUNTED: Panel shall be best suited for surface materials in which installed. Panel shall be constructed of 12-gauge stainless steel, complete with anchor straps, concealed hinges, dust tight door, and cylinder lock. All doors shall be keyed alike. Prime coated steel is acceptable for installation in painted surfaces. U. L. Listed for 1-1/2-hour rating.

D. DUCT MOUNTED: Galvanized steel construction with four cam latches. Provide 1" fiberglass insulation for insulated ducts. Minimum size of 16"x16" unless limited by duct size.

E. ACCEPTABLE MANUFACTURERS: Acudor, Mi-Fab, and Zurn.

2.11 SLEEVES

A. Provide sleeves for all piping passing through walls, floors not on grade, and roof slabs. Make sleeves of galvanized pipe and sized to provide clearance of 1/4" around piping or pipe insulation if pipe is insulated. Set end of sleeve flush with the surrounding surface of wall or ceiling in which sleeve is installed. Floor slab sleeves shall extend 3" above floor level.

B. Sleeves through floors and through fire walls shall be fire caulked or otherwise protected to maintain the fire rating of the wall/floor.

2.12 PLATES

A. Provide chromium plated wall and ceiling plates for all exposed piping, at point piping passes through walls or ceilings. Plates shall be large enough to completely cover pipe sleeves. On insulated piping, inside diameter of plates shall just exceed outside diameter of pipe covering. Plates may be omitted for pipe sizes larger than 3".

2.13 DIELECTRIC UNIONS

A. Provide dielectric insulating unions at all connections between dissimilar metals.

2.14 HEAT TRACE SYSTEM

A. GENERAL: Install Heat Trace freeze protection system on mechanical piping where noted on the Drawings or in these specifications.

B. MATERIALS: Raychem XL-Trace self-regulating heat tape, Catalog 5XL2-CR, 5 watts per foot, 208 volts. Provide power connection kit for plugging into a receptacle, end seal, and thermostat.

C. INSTALLATION: Install straight along bare pipe wrapping around valves. Tie wrap to pipe at short intervals. Installation shall be in accordance with manufacturers recommendations.

2.15 CARBON MONOXIDE (CO) MONITOR

A. GENERAL: Provide a CO monitor for each room where gas-fired boilers or water heaters are installed.

B. REQUIREMENTS: Monitor shall comply with NFPA requirements and disable boilers within the same room and provide audible alarm. Interconnect sensor to each boiler and provide expanders as necessary.

C. MANUFACTURER: US Draft Co. Model CGM-505

2.16 VIBRATION ISOLATION

A. GENERAL: All vibration isolation devices shall be designed and furnished by a single manufacturer, or supplier, who will be responsible for adequate coordination of all phases of this work. Submittal data shall show type, size, and deflection of each isolator proposed.

B. CORROSION PROTECTION:
1. All vibration isolators shall be designed or treated for resistance to corrosion.
2. Steel components shall be PVC coated or phosphated and painted with industrial grade enamel. All nuts, bolts, and washers shall be zinc electroplated. Structural steel bases shall be thoroughly cleaned of welding slag and primed with zinc chromate or metal etching primer. A finish coat of industrial enamel shall be applied over the primer.

C. SELECTION: Spring deflections listed are static deflection and are minimum requirements. Isolation efficiencies listed are the minimum required. The springs shall be capable of 30% over-travel before becoming solid (minimum 1/2" clearance at final inspection). All isolators supporting a given piece of equipment shall be selected for approximately equal deflection.

D. FIRST TWO PIPE HANGERS FROM EACH PIECE OF EQUIPMENT ISOLATED ON SPRINGS: Provide a spring hanger consisting of a rectangular steel box, coil spring, spring cups, neoprene impregnated fabric washer and steel washer. The hanger box shall be capable of supporting a load of 200% of rated load without noticeable deformation or failure. Static deflection shall be equal to isolation units supporting equipment to which piping is connected.

E. FIRST TWO PIPE HANGERS FROM EACH PIECE OF EQUIPMENT ON ISOLATORS OTHER THAN SPRINGS: Provide an elastomeric hanger, consisting of a rectangular steel box and an elastomeric isolation element, which shall be of Neoprene or high-quality synthetic rubber with anti-ozone additive. The elements shall be designed for approximately 1/4" deflection and loaded so that deflection does not exceed 15% of the free height of the element. The design shall be such as to prevent metal-to-metal contact between the hanger rod and the steel box.

F. AIR HANDLING UNITS: Units are internally isolated from the factory.
1. GENERAL: Provide an aluminum housed, adjustable, spring mounting having telescoping top and bottom sections separated by resilient inserts of neoprene or other suitable material to limit horizontal motion. The inserts shall be permanently lubricated to minimize vertical friction. Steel or cast-iron housings may be used if they are cadmium plated or hot-dip galvanized after fabrication. A neoprene pad having a minimum thickness of 1/4" shall be bonded to the base plate. Amber Booth XLS, Style A.
2. FLOOR MOUNTED AT GRADE LEVEL:
   a. 5 HP OR LESS: 1" deflection, 90% efficiency.
   b. 7½ HP THRU 20 HP: 1½" deflection, 90% efficiency.
3. FLOOR MOUNTED ABOVE GRADE:
   a. 5 HP OR LESS: 1½" deflection, 95% efficient.
   b. 7½ HP THRU 30 HP: 2" deflection, 95% efficiency.
4. STRUCTURE SUPPORTED UNITS: Spring hanger, same as pipe hanger.
   a. 5 HP OR LESS: 1½" deflection, 95% efficient.

b. 7½ HP THRU 20 HP: 2" deflection, 95% efficiency.

G. PUMPS: Mount floor mounted pumps on a Concrete Poured Form (CPF) inertia base consisting of steel pouring frame with reinforcing bars welded in place and inboard isolator attachments with Amber/Booth Type RSW-1 spring isolators, 1" deflection.

H. FLEXIBLE HOSE: Flexible connections at pumps shall be stainless steel flexible hose with flanges and stainless-steel wire braid. Amber Booth Type SS-FP.

I. FLEXIBLE COUPLINGS: Condenser water connections at fiberglass cooling tower shall be Resistoflex Style R6905, molded TFE Teflon expansion joint with limit stops. Local representative's telephone number is (713) 672-7521

J. AIR COMPRESSOR: Mount air compressor on a pad type mounting consisting of two layers of 3/8" ribbed neoprene bonded to galvanized steel separator plate with free hole drilled through all. Provide top bearing plate with hole to spread point loads. Size pads for approximately 40 PSI load.

K. CHILLERS: See Chiller Specification.

L. FANS:
1. GENERAL: This Section refers to in-line fans and other structure hung fans including CVT/VAV BOXES.
2. FANS LARGER THAN .5 HORSEPOWER: Provide a spring hanger consisting of a rectangular steel box, coil spring, spring cups, neoprene impregnated fabric washer and steel washer. The hanger box shall be capable of supporting a load of 200% of rated load without noticeable deformation or failure. Size for 1½" deflection, 95% efficient.
3. SMALL HORSEPOWER, STRUCTURE MOUNTED FANS INCLUDING CVT BOXES: Provide an elastomeric hanger, consisting of a rectangular steel box and an elastomeric isolation element, which shall be of Neoprene or high quality synthetic rubber with anti-ozone additive. The elements shall be designed for approximately 1/4" deflection and loaded so that deflection does not exceed 15% of the free height of the element. The design shall be such as to prevent metal-to-metal contact between the hanger rod and the steel box.

M. ACCEPTABLE MANUFACTURERS: Amber/Booth, Kinetics, Korfund, Mason, Peabody, Vibra-Sonics, Vibration Mountings and Southeastern Hose.

2.17 EXCAVATION AND BACKFILLING

A. GENERAL: Provide all excavation and backfilling required for the proper installation of all underground piping and other components installed below grade.

B. EXCAVATION: Trench with ladder type trenching machine. Make trenches 12" to 18" wider than outside diameter of pipe. Excavate, backfill, and grade trench bottom to required slope. Verify slope with laser level or approved device. Cut out bedding for pipe joints to provide solid bearing surface for entire length of pipe. Backhoe may be used to excavate trench if bottom is properly sloped and compacted to proper grade prior to installation of the piping.

C. BACKFILLING:
1. For non-drainage lines, backfill with approved backfill material to 95% standard proctor, by hand compaction.
2. For drainage lines, the lower 12" shall be backfilled with cement-stabilized sand with top surface shaped to accommodate pipe including joints, at the proper flowline. Grading shall be determined by laser level. After installation of the pipe, backfill to 1/2 the diameter of the pipe with cement stabilized sand. The remainder of the excavation shall be backfilled with approved backfill material to 95% standard proctor, by hand compaction. Do not place backfill material or second layer of cement stabilized sand until the piping and joints have been inspected and approved.
3. Backfill for pipe in City Property must comply with City requirements.

D. SAFETY SYSTEMS: Refer to Architectural Sections for additional requirements.

END OF SECTION

SECTION 23 05 93

TEST AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

1.2 GENERAL REQUIREMENTS

A. Contractor shall complete the HVAC systems installation and ensure it is operating in the specified manner in a timely manner so the third-party Testing and Balancing Contractor may complete his work prior to substantial completion.

B. Provide all instruments and equipment required to pre-balance the system. All instruments shall be in accurate calibration and shall be calibrated in ranges that will be expected.

1.3 DESIGN CONDITIONS

A. The air conditioning systems have been designed and the equipment selected to perform as follows:

Summer Conditions

Indoor Temperatures	74° F DB 60% RH
Outdoor Temperatures	95° F DB 80° F WB

Winter Conditions

Indoor Temperatures	70° F DB
Outdoor Temperatures	20° F DB

PART 2 - MATERIALS AND METHODS

2.1 GENERAL

A. The HVAC contractor shall clean and adjust all systems as described in paragraph 2.2.

B. The testing, adjusting, and balancing (TAB) of the air conditioning systems and related equipment for the Owner will be performed by an impartial, technical TAB firm selected and employed by the Owner as described in paragraph 2.3. The cost to employ the TAB firm shall not be borne by the Division 23 contractor.

2.2 HVAC

A. BOILER INSTALLATION:
1. GENERAL: Before initial firing, the manufacturer's representative shall certify that the installation is safe for firing.
2. OPERATIONAL TEST: Check operation and proper sequencing of all operating safety controls and devices. Check pressure relief valve for opening at proper pressure. Make Orsat flue gas analysis and adjust firing for proper air-gas mixture.
3. BOILER LICENSE: Contractor shall provide completed boiler installation report and temporary boiler operating permit on forms downloaded from: http://www.license.state.tx.us/boilers/blrforms.htm.

B. HVAC CONTRACTOR'S SCOPE OF WORK
1. The contractor shall operate the systems for the length of time necessary to properly verify their completion including final adjustments, balancing, and readiness for Owner's TAB firm.

2. The HVAC Contractor shall provide, and coordinate services of qualified personnel and equipment suppliers as required to correct, repair, or replace all deficient items or conditions found during the testing, adjusting, and balancing period.
3. The HVAC Contractor shall make any changes in the sheaves, belts, dampers, valves, and pump impellers required by the TAB firm to balance the system, at no additional cost to the Owner.
4. Contract completion schedules shall provide sufficient time to permit the completion of TAB firm's services prior to Owner occupancy.
5. The Drawings and Specifications have indicated valves, dampers, and miscellaneous adjusting devices for the purpose of adjustment to obtain optimum operating conditions. Should any such device not be readily accessible, the contractor shall provide access as requested by the TAB firm. Any malfunction encountered by TAB personnel and reported to the contractor or to the inspector shall be immediately corrected by the contractor so the balancing work can proceed.
6. The TAB firm will not have a contractual relationship with this contractor but will be responsible to the Inspector and Owner for the satisfactory execution of the TAB work. The contractor shall allow sufficient funds in the project cost estimate and bid proposal to provide all work which may be required in the TAB phases as defined herein and as may be necessary for the completion of the TAB work as defined by the TAB firm.

C. RELATED WORK

1. The contractor shall have the building and air conditioning systems in complete operational readiness and shall perform all other items as described herein to assist the TAB company in performing the balancing, testing, and adjusting of the HVAC systems.
2. For the air distribution systems, the contractor shall complete and verify the following:
   a. Verify installation for conformity to design.
   b. All supply, return and exhaust ducts shall be completed. All volume, splitter, extractor, and fire dampers properly located and functional. Dampers shall provide tight closure and full opening, smooth and free operation.
   c. All supply, return, exhaust, transfer grilles, registers, diffusers and terminal units installed, leak tested and operational.
   d. Air handling units and ductwork shall be sealed to eliminate excessive by-bass or leakage of air.
   e. All air handling units and fans shall be operating and verified for freedom from vibration, proper fan rotation, and belt tension. Starter overload heater elements shall be properly sized and clean filters installed.
3. For the water circulation systems, the contractor shall complete the following:
   a. Check and verify pump alignment and rotation.
   b. Water systems shall be cleaned and treated. All strainers shall be cleaned for normal operation. Water circulating systems shall be full and free of air; all vents installed at high points of systems.
   c. Check each motor amperage and voltage to ensure readings do not exceed nameplate rating.
   d. Verify electrical overload heater elements to be of proper size and ratings.
   e. Check and set operating temperatures of heat exchangers to design requirements.
4. For the automatic controls systems, the contractor shall complete the following:
   a. Verify that all control components are installed in accordance with project requirements, a point-to-point check of all DDC and computer controls has been completed, and that all controls are functional.
   b. All controlling instruments calibrated and set for design conditions.
5. The contractor and the suppliers of the equipment installed shall all cooperate with the TAB firm to provide all necessary data on the design and proper application of the system components and shall furnish all labor and material required to eliminate any deficiencies or mal-performance. Furnish a list of all motors with nameplate data and size of overload heater installed with motor amperage during operation.
6. During the balancing, the temperature regulation shall be adjusted for proper relationship between controlling instruments and calibrated by the Controls Manufacturer using data submitted by the TAB firm. The correctness of the final setting shall be proven by taking hourly readings for a period of three successive eight-hour days in a typical room on each separately controlled zone. The total variation shall not exceed 2° F from the preset medium temperature during the entire temperature survey period.
7. In all fan systems, the air quantities shown on the plans may be varied as required to secure a maximum temperature variation of 2° F within each separately controlled space, but the total air quantity indicated for each zone must be obtained.
8. The contractor shall assist the TAB firm in performing three inspections approximately 30 days apart within 90 days after occupancy of the building to ensure that satisfactory conditions are being maintained throughout and to correct any unusual condition.
9. The contractor shall assist the TAB firm in performing inspections in the building during the opposite season from that in which the initial adjustments required to produce optimum operation of the system components, to produce the proper conditions in each conditioned space.

D. STORAGE
1. The contractor shall provide the TAB firm a secure area of ample size, conveniently located for storage of tools, equipment, and other items as required.

E. NOTIFICATION
1. Systems shall be complete and in operational readiness prior to notifying the Owner and Owner selected TAB firm that the project is ready for the services of the TAB firm and the contractor shall so certify in writing to both aforementioned parties that such a condition exists.
2. Should the Owner selected TAB firm shall be so notified and the TAB work commence and the systems are found to not be in readiness or a dispute occurs as to the readiness of the systems, the contractor shall request an inspection be made by the Owner. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for TAB services. Should the inspection reveal the notification to have been premature, all costs of the inspection and work previously accomplished by the TAB firm shall be paid for by the contractor. Furthermore, such items that are not ready for TAB services shall be re-tested. Complete, operational readiness, prior to commencement of TAB services, shall include the work described in RELATED WORK above.

2.3 HVAC TESTING, ADJUSTING, AND BALANCING

A. The testing, adjusting, and balancing of the air conditioning systems will be performed by an impartial technical firm whose operations are limited only to the field of professional TAB. The TAB work shall be done under the direct supervision of a qualified engineer employed by the TAB company, who shall have a minimum of five (5) years of experience conducting tests and measurements of the type specified. Work shall be in accordance with procedures and techniques as outlined in the ASHRAE Systems Handbook in Chapter 57 on TAB and procedural standards for TAB, National Environmental Balancing Bureau.

B. The TAB firm shall be responsible for inspecting, adjusting, balancing, and tabulating the data on the performance of fans, all dampers in the duct systems, all air distribution devices and the flow of water through all coils. The Mechanical Subcontractor, the various subcontractors involved, and the suppliers of the equipment installed shall all cooperate with the TAB firm to provide all necessary data on the design and proper application of the system components and shall furnish all labor and material required to eliminate any deficiencies or malperformance.

C. Professional firms will be selected from the Owner’s pre-approved vendor list.

D. QUALIFICATIONS OF THE FIRM
1. The firm shall be one which is licensed to do professional services of this specified type in the State of Texas and as a minimum, have one professional engineer licensed in the State of Texas, with current registration, to perform such professional services.
2. The firm shall have a minimum of five (5) years operation under its current firm name.
3. The firm shall be capable of performing the services specified at the location of the facility described within the time specified, preparing and submitting the detailed report of the actual field work performed and following up the basic work as may be required.
4. The firm performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
5. The firm performing the work shall be 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.
6. The firm performing the work shall be a specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
7. 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.
8. The firm performing the work must be local to the Greater Houston area.

E. DOCUMENTS
1. The Owner will provide plans, specifications, and change orders to the TAB firm.
2. The Owner will provide approved submittal data on equipment installed.
3. The Owner will transmit one copy of the following “Records for Owner” to the TAB firm for review and comment:
   a. “As-Installed” Drawings
   b. Approved Fixture Brochures, Wiring Diagrams and Control Diagrams
   c. Shop Drawings
   d. Instructions

e. Valve Charts

F. RESPONSIBILITY OF THE TAB FIRM

1. The TAB personnel shall check, adjust, and balance the components of the air conditioning system in order to achieve optimum noise, temperature, and air flow conditions in the conditioned spaces of the building while the equipment is operating economically. This is intended to be accomplished after the system components are installed and operating as provided for in the contract documents, which is the responsibility of the project contractor.
2. The tests shall demonstrate the specified capacities and operation of all equipment and materials comprising the systems. Such tests shall be made as are deemed necessary by the Architect to indicate the fulfillment of the contract. The TAB firm shall then make available to the Engineer such instruments and technicians as are required for spot checks of the systems.
3. The TAB firm will not instruct nor direct the contractor in any of the work. Any proposed changes or revisions in the work shall be submitted to the Architect in writing. The Architect will process the proposal as needed.

G. BALANCING SERVICES

1. The TAB firm, Architect, and Owner will inspect the installation of heating and cooling piping systems, sheet metal ductwork, temperature controls, and other component parts of the HVAC systems. The inspection of the work will cover the portion of work relating to proper arrangement and adequate provisions for the testing and balancing. The inspections shall be performed periodically as the work progresses.
2. Upon formal notification of completion of the installation and start-up of the mechanical equipment by the contractor, TAB firm will balance, test, and adjust the system components to obtain optimal conditions in each conditioned space in the building.
3. The TAB firm shall be responsible for inspecting, balancing, adjusting, testing, and compiling the data on the performance of fans, all dampers in the duct systems, all air distribution devices or heat exchangers, and the water flow through all coils.
4. The TAB firm shall, fourteen days prior to Final Inspection, as requested by the Owner, prepare seven copies of the completed Test and Balance Report. The report shall be complete with logs, data, and records as required herein and all logs, data, and records shall be typed, produced on white bond paper and spiral bound. The report shall be certified accurate and complete by a principle engineer of the TAB firm. Transmit one copy directly to the Owner's Representative and the remaining six copies to the Architect. The Architect will review and approve the report. Upon approval, two copies will be submitted to the Owner's Representative and two copies transmitted to the Contractor.

H. REPORT: After balancing is complete and before calling for final observation, record and submit for record, the following data:

1. For each chilling unit:
   a. Water temperature entering and leaving cooler.
   b. Water pressure entering and leaving cooler.
   c. Water temperature entering and leaving condenser (air temperatures for air cooled unit).
   d. Water pressure entering and leaving condenser with flow points marked.
   e. Pressure drop - flow curves for cooler and condenser with flow points marked.
   f. Motor nameplate F.L.A., actual amps, and voltage.
   g. Compressor suction and discharge pressures.
2. For each pump:
   a. Suction and discharge pressure readings at shut off.
   b. Suction and discharge pressure readings at final balance flow.
   c. Motor nameplate F.L.A., actual amps at rated flow, voltage, and verify rotation.
   d. Copy of pump curve, with final balance point marked.
3. Each Air Handling Unit:
   a. Total supply, return, and outside air CFM.
   b. Suction and discharge static pressure, total static pressure.
   c. Fan RPM measured by tachometer. Verify rotation.
   d. Motor nameplate F.L.A., actual amps, and voltage.
   e. Entering and leaving air temperature for each coil at full water flow.
   f. Entering and leaving water temperature for each water coil at full flow.
   g. Coil water pressure drop with point marked on flow curve at full flow.
   h. CFM of each outlet served by unit.
4. Each Supply or Exhaust Terminal Box:
   a. Total supply CFM in full cooling.
   b. CFM of each outlet served by unit when in full cooling.

c. Entering and leaving air temperature for heating coil at full water flow (or fully energized for electric reheat).
d. Entering and leaving water temperature for heating coil at full water flow.

5. For each Supply and Exhaust Fan:
   a. Suction and discharge static pressure, total static pressure, and total CFM.
   b. Fan RPM measured by tachometer. Verify rotation.
   c. Motor nameplate F.L.A., actual amps and voltage.
   d. CFM of each outlet served by fan.

6. Each Boiler:
   a. Safety inspection authority approval certificate.
   b. Orsat flue gas analysis report.
   c. Operating pressure and temperature.
   d. Safety control setting points.

7. Each condensing unit:
   a. Ambient air temperature and condenser discharge temperature.
   b. Motor nameplate F.L.A., actual amps, and voltage.
   c. Suction and discharge pressures and temperatures.
   d. Verification that moisture indicator shows dry refrigerant.
   e. Settings of all operating and safety control.

8. For each data value that cannot be balanced to meet scheduled design value:
   a. List the cause of the discrepancy between the actual data and the design value.
   b. List corrective action that must be taken to meet design value.
   c. Note that “Not Operating” is not an acceptable entry into the Testing and Balancing report. If a piece of equipment is not operating during the testing and balancing process, TAB firm must contact the Mechanical Contractor. Mechanical Contractor will repair system as required. TAB firm will then test and balance the system as specified.

I. REPORT APPROVAL
1. After report is submitted and reviewed by Engineer, Test and Balance Contractor shall meet with the Engineer at the site to review balancing problems and perform a random check of data values listed in report. Contractor shall bring all necessary testing and balancing equipment to site necessary to measure values.

J. AFTER OWNER OCCUPANCY:
1. After Owner has occupied and is using the building, make three additional inspections of the system during the one-year warranty period (at times directed by Owner) to:
   a. Correct any Owner observed temperature imbalances.
   b. Architect for each trip. List in the letter corrections made.

2. At the season opposite that of startup, inspect and verify correct operation of all systems. Make adjustments as required.
3. Extended Warranty.
   a. a. Include an extended warranty of 2 years after completion of the test and balance work, during which time the Architect/Engineer may request a reset or resetting of any outlet or other items as listed in the test report.
   b. Provide technicians and instruments to assist the Architect/Engineer in making any test he may require during this period.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23 apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 GENERAL REQUIREMENTS

A. Install all insulation in conformance with manufacturer's recommendations and these specifications.

B. Insulation materials manufactured by the following list of companies will be acceptable provided their materials conform to these specifications: Armacell, CertainTeed, Knauf, Insulphen, Manville, Polyguard, and Owens-Corning.

C. Flame Spread and Smoke Requirements:
1. All jackets, adhesives, coatings, insulating materials, and vapor barrier mastics for piping and equipment shall have a flame spread not higher than 25 and smoke developed rating not higher than 50 (IMC 2015 602.2.1)
2. All materials containers shall have a U. L. Label.

D. At each pipe support point, provide 10” long, formed 16-gauge galvanized sheet metal saddle. For piping 1½” and larger, install a hard section of Insulphen K phenolic foam pipe insulation the same length as the pipe saddle. Seal and finish to match adjoining insulation.

E. Install .020" thick aluminum jacket with minimum 2” overlap joint on all insulated piping exposed outside building. Install factory made aluminum covers on all elbows. Cut aluminum neatly to fit all tees, such that all insulation is covered by aluminum. Use waterproofing, aluminum-colored Foster 95-44, or Childers CP-76-1 sealer to seal all joints. Provide .020” x 3/4” aluminum bands not more than 12" on center for all jacketing. Install aluminum covers on insulated pipe inside that is exposed to view in finished areas including inside gymnasiums. Cover is not required in mechanical or AHU rooms.

PART 2 - MATERIALS AND METHODS

2.1 CONDENSATE DRAINS

A. Insulate all condensate drain lines in same manner as specified for Heating Water Piping, except 1/2" thick. Exposed piping located close to the floor inside an equipment room, from an air handling unit to floor drain, need not be insulated.

2.2 LAP AND JOINT ATTACHMENT

A. Self-sealing type jackets will be acceptable provided the laps are sealed per the manufacturer’s recommendations.

2.3 REFRIGERANT PIPING

A. Reference specification section 23 07 01

2.4 DUCT INSULATION

A. GENERAL: Insulate all supply air ducts, return air ducts through un-insulated spaces and outside air ductwork, including kitchen hood supply air ducts and dryer vent. Insulate exhaust ducts down stream of inline fan backdraft damper. Insulate backs of air devices where ceiling above is not used as a return plenum.

B. DUCTS INDOORS: 2” thick, 1 pound density (Type 100) fiberglass flexible duct insulation, with a conductivity (k) value not more than 0.27 at 75° mean temperature difference for an installed R value of 8 or higher. Insulation shall have a factory adhered reinforced foil faced flame resistant Kraft paper vapor barrier. Wrap around duct with minimum lap of 2 inches each way, staple with 1/2" outward clinch staples 2” on center, secure on bottom of duct with water based, fire retardant adhesive (Foster 85-60 or Childers CP-127). For ducts 24” to 30” wide, provide one row of pins on bottom of duct, 16” on center. For wider ducts provide one row on bottom of duct for each 16” of width. Trim pins flush with retainer disk. Seal all with tape with Foster 30-80AF vapor barrier coating. For ducts in mechanical rooms, reduce spacing to 12” on center for each 12” of dimension (all sides of duct). Seal joints and seams with 3" wide FSK foil tape, including termination of flex ducts, and coat tape with Foster 30-80AF vapor barrier coating. Where insulation terminates at equipment (AHU, fan coil, VAV box, etc) and where insulation is custom fitted to transitions and elbows, add glass cloth strip adhered with anti-fungal Foster 30-80AF vapor barrier coating between equipment and insulation cover. Coating permeance shall be 0.013 perms or less at 43 mil dry thickness as tested by ASTM E96 and meet ASTM D5590 with 0 growth rating.

C. EXPOSED AREAS INSIDE: Add reinforcing mesh for exposed areas, tack coat with anti-fungal Foster 30-80AF vapor barrier coating, and finish with flood coat of Foster 30-80AF. Coating vapor permeance shall be 0.013 perms or less at 43 mil dry thickness as tested by ASTM E96 and meet ASTM D5590 with 0 growth rating. Reinforcing mesh shall be 10x10 Childers Chil-Glas #10 or Foster Mast-a-Fab. Ductwork inside mechanical and air handling unit rooms is not considered exposed ductwork.

D. DUCTS OUTSIDE: Externally insulate with a minimum of 2" thick urethane board sealed with Foster 30-65 or Childers CP-34 with embedded layer of reinforcing mesh to achieve an installed R value of 8. Coating vapor permeance shall be 0.03 perms or less at 45 mil dry thickness as tested by ASTM E96. Apply 3M Venture Clad jacketing.

E. DUCTS THROUGH NON-FIREWALLS: Install reinforcing mesh on insulation for ducts passing through walls the same as for C. EXPOSED AREAS INSIDE. Mesh shall extend 6” beyond wall on either side of the wall.

F. INTERNALLY LINED DUCTWORK: Duct liner have a "K" ('ksi') value per ASTM C518, 0.24 at 75°F (0.036 at 24°C) based on 1" material thickness. Maximum rated velocity of 6000 FPM (30.5 Meters/Second). Duct liner shall have a FHC of 25/50 and be classified as meeting the requirements of limited combustibility. All portions of duct designated to receive liner shall be completely covered with 1"(or other specified thickness) of Linacoustic RC. All sections shall be neatly butted together so that there are no interruptions or gaps. Adhere liner to metal with a full coverage of adhesive meeting ASTM C916. Secure duct liner with mechanical fasteners in accordance with SMACNA and NAIMA Standards. Install metal nosing on all leading edges of liner when velocity exceeds 4000 FPM. SuperSeal will be used to coat all circumferential joints, exposed edges, and minor surface damage after the liner is in place. F. SuperSeal HV will be used to fill minor gaps and indentations.
   1. Manufacturers: Johns Manville Linacoustic RC or approved equal

2.5 CHILLED WATER PIPING

A. GENERAL: Insulate all chilled water piping, valves, fittings, air separators, tanks, filter feeders, and other items subject to condensation. Insulate chiller connections to chiller barrel insulation so there is no break in the insulation of the system.

B. PIPE:
   1. MATERIALS: Molded Insulphen phenolic foam pipe insulation, 3.7 pounds per cubic foot density, conductivity (k) not higher than .14 at 100° mean temperature difference with factory attached fire retardant, vapor barrier jacket. Insulation inside building above ceilings or 7 feet above floor in mechanical rooms may be 2.2 pound per cubic foot density.

2. EXECUTION: Install insulation over pipe and carefully connect self-sealing laps. Provide 3" butt strips at each joint between sections, sealed with Foster 85-75 or Childers CP-82 adhesive. Coat all vapor retarder film (ASJ) longitudinal and butt joints with Foster 30-80AF anti-fungal, vapor barrier coating to prevent moisture ingress. Coating permeance shall be 0.013 perms or less at 43 mil dry thickness as tested by ASTM E96 and meet ASTM D5590 with 0 growth rating. Apply Foster 95-50 or Childers CP-76 insulation joint sealant on all phenolic insulation longitudinal and butt joints to prevent moisture ingress.

C. VALVES, FITTINGS AND OTHER COMPONENTS:
1. MATERIALS: Pre-molded cover of same materials and thickness as pipe covering.
2. EXECUTION: Provide vapor barrier coating consisting of a tack coat of white Foster 30-80AF anti-fungal, vapor barrier coating with reinforcing mesh, finished with a 1/16" thick coating of Foster 30-80AF vapor barrier coating. Coating permeance shall be 0.013 perms or less at 43 mil dry thickness as tested by ASTM E96 and meet ASTM D5590 with 0 growth rating. Finish all joints and seams smooth and even. Reinforcing mesh shall be 10x10 Childers Chil-Glas #10 or Foster Mast-a-Fab. This application shall provide a minimum dry film thickness of 37 mils.

D. PHENOLIC FOAM THICKNESS: 2”

2.6 BUILDING HEATING WATER PIPING

A. GENERAL: Insulate all hot water piping with factory molded fiberglass pipe insulation with factory attached fire retardant jacket. Insulation shall be 3 pounds per cubic foot with conductivity (k) not higher than .25 at 100° mean temperature difference. Piping insulation outside shall be thicker.

B. THICKNESS: 1½” thick for pipes 1½” and smaller. 2” thick for larger pipes. Increase thickness by 1/2” if piping is outside.

C. INSTALLATION: Secure all laps and joints with staples at 4" on center. Provide 3" butt strips at each joint between sections.

D. FITTINGS: Insulate fittings with pre-molded cover of same materials and thickness as pipe covering

2.7 CHILLED WATER PUMP

A. GENERAL: Insulate all cold surfaces as required to prevent condensation. Do not insulate pump until the chilled water system has been balanced.

B. MATERIALS: Fiberglass board with minimum 6 pounds per cubic foot density or 2" thick foam glass.

C. INSTALLATION: Cut and form to fit or foam in place. Fill any voids with flexible glass fiber insulation. Seal all joints with Foster 30-80AF. Coating permeance shall be 0.013 perms or less at 43 mil dry thickness as tested by ASTM E96 and meet ASTM D5590 with 0 growth rating. Apply tack coat white Foster 30-80AF vapor barrier coating and then a 1/16" thick finish coat of same material. This application shall provide a minimum dry film thickness of 37 mils.

2.8 CHILLED WATER AND HOT WATER SYSTEM EXPANSION TANK, AIR SEPARATORS, STORAGE TANK AND FILTER FEEDER

A. Insulate with 1" thick Insulphen K phenolic foam, or K-flex closed cell foam insulation with vapor barrier. Equal product by Armacell or Polyguard is acceptable.

B. When installed outdoors, insulation shall be 2” thick with aluminum jacketing. Insulation shall be factory applied.

END OF SECTION

SECTION 23 07 01

REFRIGERANT PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 GENERAL REQUIREMENTS

A. Section includes insulating the following HVAC piping systems.
1. Refrigerant suction (low pressure gas) piping.
2. Refrigerant hot gas (discharge or high pressure gas) piping.
3. Refrigerant liquid piping, for VRF/VRV and Heat Pump systems.

B. Install all insulation in conformance with manufacturer's recommendations and these specifications.

C. Flame Spread and Smoke Requirements:
1. All jackets, adhesives, coatings, insulating materials and vapor barrier mastics for piping and equipment shall have a flame spread not higher than 25 and smoke developed rating not higher than 50.
2. All materials containers shall have a U. L. Label.

D. Install .020" thick aluminum jacket with minimum 2” overlap joint on all insulated piping exposed outside building. Install factory made aluminum covers on all elbows. Cut aluminum neatly to fit all tees, such that all insulation is covered by aluminum. Use waterproofing aluminum colored Foster 95-44 or Childers CP-76-1 sealer to seal all joints. Provide .020x3/4” aluminum bands not more than 12" on center for all jacketing.

E. Material to be delivered in new condition, free of defects and stored in a clean, dry space that provides protection against damage and contamination.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Flexible Elastomeric Foam: EPDM - Closed cell expanded rubber. Comply with ASTM C 534, Type I for tubular materials for refrigeration pipe sizes 1/4" and greater.
1. Outdoor Use:
a. Provide Reftekk AC-SSPT (EPDM pre-split with lap seal and field applied Aeroflex Aerocoat)
b. Aeroflex, EPDM SSPT with field applied Aerocel Aerocoat
c. Armacell, LLC, EPDM UT Solaflex, Pre-split with lap seal and with field applied Black PVC jacket
2. Indoor Use:
a. Provide Reftekk AC-SSPT (EPDM pre-split with lap seal)

b. Aeroflex, EPDM SSPT
c. Armacell, LLC, EPDM UT Solaflex, Pre-split with lap seal

3. Applied to Annealed Coiled Tubing (Line Sets), Basis of Design Product: EPDM continuous tube.

B. Elastomeric insulation shall not use CFC's or HFC's in the manufacturing process.

C. Elastomeric insulation shall have a flame spread-index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 for all products through 2" thickness.

D. Elastomeric insulation and elastomeric joining system shall be suitable of use from -70°F to 257°F continuous service temperature, per ASTM C 411.

E. Elastomeric insulation shall have a maximum thermal conductivity of 0.235 Btu-in/h-ft2-°F at a mean temperature of 75°F when tested in accordance with ASTM C 177 or ASTM C 518.

F. Elastomeric insulation shall have a maximum water vapor transmission of ≤0.03 perm-inch when tested in accordance with ASTM E 96, Procedure A, latest revision.

G. Elastomeric insulation must exhibit long-term UV resistance in outdoor installation per ASTM G 7 and ASTM G 90.

H. Elastomeric insulation must not contribute to external stress corrosion cracking when tested per ASTM C 692.

2.2 ADHESIVES, AND TAPES

A. Flexible Elastomeric Adhesive for Indoor and Outdoor Application:
1. Provide Aeroflex AeroSeal contact adhesive or Armacell, LLC HT 625 contact adhesive.

B. Seaming tape to be 15-mil EPDM rubber with acrylic adhesive.

2.3 INSULATING PIPE HANGER SUPPORTS

A. Support the piping system using high density rigid foam insulating pipe hanger supports with an inner lining of EPDM rubber insulating tape and 15-mil exterior EPDM rubber jacket. Insulation density to be a minimum of 10 lb. / cu. ft. with a compressive strength of 284 PSI or greater, and a k-value of 0.312 or lower. Continuous use temperature range to be -70°F to 257°F with water absorption of 5% or less.
1. Provide insulated pipe support complete with matching steel channel insulation OD clamp:
a. Reftekk "Cush-A-Therm", model UX
b. Aeroflex USA, Aerofix-U
c. Armaflex LLC, Armafix

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and free of leaks and defects
2. Verify that surfaces to be insulated are clean, dry and free of dirt, dust, grease, frost, and moisture.
3. Work shall be performed at the installation temperatures recommended by the product manufacturer.
4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Tape seams and lap seam tape overlaps shall be clean dry, fan free of dirt, dust, grease, frost and moisture.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. All piping, valves and fittings scheduled to be insulated to have all insulation applied in strict accordance with the insulation manufacturers installation instructions and practices described in the National Commercial and Industrial Insulation Standards Manual. In case of conflict, the manufacturers installation guidelines and instruction will be used.

B. Install insulation materials, accessories and finishes with smooth, straight, and even surfaces; free of voids, throughout the length of the piping including supports, fittings, valves and specialties.

C. Install insulation materials, vapor barriers, vapor dams, jackets, and thicknesses required for each item of the pipe system as required.

D. Install insulation with longitudinal seams oriented per the insulation manufacturers installation instructions for all horizontal runs.

E. Keep insulation dry and clean during application and finishing. Do not apply insulation to operating systems.

F. Install insulation with the least number of joints practical.

G. Piping to be insulated with tubular preformed pipe insulation.

H. Install insulation continuously through roof penetrations, wall penetrations and floor penetrations.

I. Install insulation continuously through fire rated wall and fire rated floor penetrations complying with Penetration Fire-stopping details.

J. Insulating Pipe Hanger Supports are to be installed at all pipe support and clamp locations. Insulating Pipe Hanger Supports are to be installed at the time of piping installation such that the pipe insulation system is installed in a continuous manner through the pipe support system.

K. All insulation terminations, butt joints, longitudinal joints, and access points to be properly glued or sealed with the insulation manufacturers sealant system.

L. Vapor dams to be installed every 12’ to 18’ per insulation manufacturers installation instructions, high point of piping run and at all insulation terminations (supports, valves, flanges and end of pipe runs)

M. Provide sufficient clearance between insulated pipes to allow air circulation.

N. Provide mitered insulation fittings at elbows to prevent compression of the insulation at the throat of the elbow and stretching on the outside of the bend.

O. Do not compress the insulation at penetrations or structural members, such as joists or studs. Do not allow the insulation to be compressed by ceiling hanger wires.

P. Do not allow attachment of anything to the insulated piping that will reduce the effective thickness of the insulation, such as control wiring, cabling, telephone wiring, etc. When using insulation manufacturers recommended tape on joints, do not compress the insulation.

Q. Insulation should be installed such that butt joints are in slight compression. This prevents separation of the insulation joints over time or due to changes in temperature. Do NOT apply the insulation in a stretched condition.

R. Insulation thickness shall not be less than the minimum called for by the 2015 International Energy Conservation Code, as enumerated in Table C403.2.10 and shown below.

Refrigerant Condition or Phase	Refrigerant Temperature Range (°F)	Insulation Mean Rating Temperature (°F)	ACR TUBING OUTSIDE DIAMETER								
			1/4"	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1-3/8"	1-5/8"
			INSULATION THICKNESS REQUIRED (INCHES)								
High Pressure Vapor	201-250	150			2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"	2-1/2"
	141-200	125			1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	1-1/2"	2"
Liquid	105-140	100	1"	1"	1"	1"	1"	1"	1"		
Low Pressure Vapor	40-60	75			1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1"
	Below 40	50			1/2"	1/2"	1/2"	1/2"	1"	1"	1"
For piping smaller than 1.5” and located in partitions within conditioned spaces, reduction of these thicknesses by 1” shall be permitted, but not to a thickness less than 1”.											

END OF SECTION

SECTION 23 08 00

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

1.2 SUMMARY

A. Section includes commissioning process requirements for HVAC systems, assemblies, and equipment.

B. Related Sections:
1. Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

C. The cost of the Commissioning Authority shall be selected and paid directly by the Owner.

1.3 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority

C. HVAC: Heating, Ventilating, and Air Conditioning

D. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

E. TAB: Test and Balance or Test and Balance Contractor

1.4 CONTRACTOR'S RESPONSIBILITIES

A. Perform commissioning tests at the direction of the CxA.

B. Attend construction phase controls coordination meeting.

C. Attend testing, adjusting, and balancing review and coordination meetings.

D. Participate in HVAC systems, assemblies, equipment, and component maintenance orientation and inspection as directed by the CxA.

E. Provide information requested by the CxA for final commissioning documentation.

F. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period (Test and Balance Contractor).

1.5 CXA'S RESPONSIBILITIES

A. Provide project-specific construction checklists and commissioning process test procedures for actual HVAC systems, assemblies, equipment, and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Verify testing, adjusting, and balancing of Work are complete.

D. Provide test data, inspection reports, and certificates in Systems Manual.

1.6 COMMISSIONING DOCUMENTATION

A. Contractor shall provide the following information to the CxA for inclusion in the commissioning plan:
1. Submittals, systems manuals, and other documents and reports.
2. Identification of installed systems, assemblies, equipment, and components including design changes that occurred during the construction phase.
3. Schedule for completing manufacturer's prestart and startup checklists for HVAC systems, assemblies, equipment, and components to be verified and tested.
4. Certificate of completion certifying that installation, prestart checks, and startup procedures have been completed.
5. Notification that HVAC systems, subsystems, equipment and associated controls are ready for testing.
6. Test and inspection reports and certificates.
7. Corrective action documents.
8. Testing, adjusting and balancing reports.

1.7 SUBMITTALS

A. Certificates of readiness.

B. Certificates of completion of installation, prestart, and startup activities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of HVAC testing shall include entire HVAC installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the HVAC Subcontractor, Testing, and Balancing Contractor, and HVAC Instrumentation and Control Subcontractor shall prepare detailed testing plans, procedures and checklists for HVAC systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. The CxA may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.

I. If tests cannot be completed because of a deficiency outside the scope of the HVAC system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

J. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.2 TESTING PREPARATION

A. Contractor shall certify that HVAC systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Contractor shall certify that HVAC instrumentation and control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. TAB Contractor shall certify that testing, adjusting, and balancing procedures have been completed and that testing, adjusting, and balancing reports have been submitted, discrepancies corrected, and corrective work approved.

D. Contractor shall set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlocking identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.3 TESTING AND BALANCING VERIFICATION

A. Prior to performance of testing and balancing work, Test and Balance Contractor provide copies of reports, sample forms, checklists, and certificates to the CxA.

B. Notify the CxA at least 10 days in advance of testing and balancing work, and provide access for the CxA to witness testing and balancing Work.

C. Provide technicians, instrumentation, and tools to verify testing and balancing of HVAC systems at the direction of the CxA.
   1. The CxA will notify Testing and Balancing Contractor 5 days in advance of the date of field verification. Notice will not include data points to be verified.
   2. The Testing and Balancing Contractor shall use the same instruments (by model and serial number) that were used when the original data was collected.
   3. Failure of an item includes, other than sound, a deviation of more than 10 percent. Failure of more than 10 percent of selected items shall result in rejection of final testing, adjusting, and balancing report. For sound pressure readings, a deviation of 3 dB shall result in rejection of final testing. Variations in background noise must be considered.
   4. Remedy the deficiency and notify the CxA so verification of failed portions can be performed.

3.4 HVAC SYSTEMS, SUB-SYSTEMS AND EQUIPMENT TESTING PROCEDURES

A. Boiler Testing and Acceptance Procedures: Testing requirements are specified in Division 23 Boiler Sections. Provide submittals, test data, inspector record, and boiler certification to the CxA.

B. HVAC Instrumentation and Control System Testing: Field testing plans and testing requirements are specified in Division 23 Sections "Direct Digital Control for HVAC" and "Sequence of Operations for HVAC Controls." Assist the CxA with preparation of testing plans.

C. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment requirements are specified in Division 23 piping Sections. HVAC Subcontractor shall prepare a pipe system cleaning, flushing, and hydrostatic testing plan. Provide cleaning, flushing, testing, treatment plan, and final reports to the CxA. Plan shall include the following:
   1. Sequence of testing and testing procedures for each section of pipe to be tested, identified by pipe zone or sector identification marker. Markers shall be keyed to Drawings for each pipe sector, showing the physical location of each designated pipe test section. Drawings keyed to pipe zones or sectors shall be formatted to allow each section of piping to be physically located and identified when referred to in pipe system cleaning, flushing, hydrostatic testing, and chemical treatment plan.
   2. Description of equipment for flushing operations.
   3. Minimum flushing water velocity.
   4. Tracking checklist for managing and ensuring that all pipe sections have been cleaned, flushed, hydrostatically tested, and chemically treated.

D. Refrigeration System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of chillers, cooling towers, refrigerant compressors, and condensers, heat pumps, and other refrigeration systems. The CxA shall determine the sequence of testing and testing procedures for each equipment item and pipe section to be tested.

E. HVAC Distribution System Testing: Provide technicians, instrumentation, tools, and equipment to test performance of air and hydronic distribution systems; specialty exhaust; and other distribution systems, including HVAC terminal equipment and unitary equipment.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 GENERAL REQUIREMENTS

A. Construct all piping systems in accordance with applicable ASME Codes.

B. Piping shall be installed parallel to building coordinates with vertical drops. Piping in the vicinity of equipment shall be arranged to not interfere with access panels and maintenance space. Provide unions, flanges and shutoff valves to allow removal of the equipment and its subassemblies without having to remove excessive amounts of building piping and to minimize water drainage requirements. Provide a vent valve at the topmost part and a drain valve at the lowest part of all water piping systems. Bull head Tee arrangement is not acceptable.

C. All piping, fittings and valves shall be manufactured in the United States of America.

D. Provide pipe sleeves for all insulated piping passing through a wall and all piping passing through a floor above grade.

1.3 TESTING PIPING SYSTEMS

A. GENERAL: Test all piping systems to assure that they are absolutely leak free. Pipe to be insulated shall be proven to be leak free before pipe is concealed.

B. PRESSURE TEST METHOD: Use method suitable for type of piping system being tested. Pipes that will contain water shall be leak tested with water in the piping system. For pressure pipe, use a test pressure approximately 150% of maximum system working pressure but at a minimum pressure of 60 psig. The minimum test pressure for chilled water and heating water shall be 125 psig. Maintain pressure for 8 hours. During this test period, inspect all pipe fittings and accessories in the piping and eliminate all leaks. Contractor shall inform the Engineer’s representative when testing is to be perform so he may observe methods and results.

C. FINAL TEST: Subject each piping system to its normal operating pressure and temperature for not less than twenty-four hours. The piping systems 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.

1.4 PIPE WELDING

A. GENERAL: All welds shall be made using shielded arc process. Welding shall be performed by experienced and highly skilled workmen, holding current certification by the National Certified Pipe Welding Bureau or currently certified under the requirements of the ASME Boiler and Pressure Vessel Code, Section IX. Piping and fittings shall be welded and fabricated in accordance with ASME/ANSI the latest edition of Standard B31.9 for all systems.

B. APPEARANCE: The finished weld shall have no surface voids and present a raised bead at the joint. Wire brush joint for a finished appearance. Welds lacking penetration, containing excessive porosity of cracks or are found to be unacceptable for any reason, must be removed and replaced with an original quality weld as specified herein.

PART 2 - MATERIALS AND METHODS

2.1 CHILLED AND BUILDING HEATING WATER PIPING

A. Schedule 40 black steel pipe and fittings, long radius elbows, screwed, welded or Victaulic type mechanical couplings. Piping shall be of domestic manufacture and meet ASTM ERW A-53 Grade B. Provide a sufficient quantity of Victaulic flexible type mechanical couplings in straight pipe runs to compensate for expansion. All bolts, nuts and all thread used in the piping system and components shall be cadmium plated to resist rust. Pipe connections to fan coil units shall be approximately two feet of Type L copper with wrought copper solder fittings braised.

2.2 CONDENSATE DRAIN PIPING

A. Schedule 40 galvanized steel or Type "L" copper with solder wrought fittings brazed.

2.3 GAS RELIEF AND MISCELLANEOUS PIPING

A. Schedule 40 galvanized steel or Type "L" copper with solder wrought fittings brazed.

2.4 MISCELLANEOUS PIPING

A. GENERAL: Provide all required piping not specifically shown on the drawings but necessary for the proper operation of the systems. Piping materials, methods of installation, fittings, valves, etc., shall conform, in general, to that specified for similar piping systems. Particularly note the special drain lines required for condensing boilers.

B. MISCELLANEOUS DRAINS: Provide copper drain line to floor drain from automatic air vents, backflow preventers, relief valves and other equipment with automatic drains.

2.5 FITTINGS

A. SCREWED: Conform to ANSI Specification B16.3.

B. COPPER: Conform to ANSI Specification B16.22. T-drill fittings are not acceptable.

C. WELDED: Install elbow, transition, branch and weld-o-let lateral fittings in welded systems. Mitered or field fabricated fittings are not acceptable. Flanges shall be weld neck type for sizes 6” and larger pipe.

D. SPECIAL: Use long radius elbows on all pumped lines.

2.6 GROOVED PIPING SYSTEM

A. GENERAL: The grooved coupling system may be used at contractor's option, except in all cases provide a sufficient quantity of Victaulic flexible type mechanical couplings in straight pipe runs to compensate for expansion.

B. PIPE: Use only those pipe materials allowed in the Specifications and approved by the coupling manufacturer for the application. Pipe grooves shall be machine cut for schedule 40 pipe.

C. COUPLINGS: Housings shall be ductile or malleable iron constructed to ASTM A-47 or A-536, or forged steel constructed to ASTM A-106. Coupling gaskets shall be EPDM Grade E for -30° F to 230° F service. Couplings shall be Victaulic Style 77 flexible couplings at first three joints from equipment. Elsewhere use Style 07 for rigid joints or Style 77 for flexible joints.

D. ACCEPTABLE MANUFACTURERS: Gustin Bacon, Grinnell Gruvlok, and Victaulic

END OF SECTION

SECTION 23 21 16

HYDRONIC PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 GENERAL REQUIREMENTS

A. All valves shall be manufactured in the United States of America.

PART 2 - MATERIALS AND METHODS

2.1 VALVES

A. GENERAL: Provide shutoff/balancing valve for each water connection to equipment that is piped to the condenser, chilled or heating water systems. All pressures shown below are minimum working pressures. Provide memory stops for valves used for balancing service. Provide chain operators with guide for all valves 6" and larger, located higher than 8 feet located in the main mechanical room or boiler room. Loop chain with bottom 7 feet high. Provide close-off plugs or plates for all valves in dead end service or otherwise opening to the atmosphere (drains, manual vents, future extensions, etc.).

B. BALL VALVE FOR MECHANICAL SYSTEMS: Provide for 2" and smaller pipe: 600 PSI WOG, bronze threaded, full port, Teflon seat, stainless steel trim, extension stem for insulation. Nibco T-585-70-66(-NS). Ball valves for strainer blow down and drains shall have hose end connection and attached cap. Nibco T-585-70-66-HC. Valves used for air venting may be non-full port type with chrome plated ball. Nibco T-580-70.

C. GATE VALVE FOR MECHANICAL SYSTEMS: Provide for steel pipe 2½" and larger only: 125# iron body, bronze fitted, flanged, bolted bonnet, solid wedge, OS&Y. Nibco F-617-0.

D. PLUG VALVE FOR MECHANICAL SYSTEMS: Bronze or iron body, screwed for 2" and smaller, flanged for 2½" and larger, eccentric plug with compressible resilient seal suitable for 250° F water service, permanently molded to plug face, permanently lubricated corrosion resistant bearing bushings, lever actuator. DeZurik Series 100 and 400

E. CHECK: 2" and under, 125# bronze body, bronze swing check with Teflon seat; 2½" and over 125# iron body, flanged, bronze trim. Use Duo-Check for pumped lines. Nibco T-413-Y, Nibco W-920-W or Mission "Duo-Check"

F. BUTTERFLY: 2½" and larger, 200# full lug ductile iron type body, stem seals, molded in or renewable seat, aluminum bronze disc, 416 stainless steel stem, extended neck for insulated lines, notched top plate with handle for throttling. Valves 6" and larger and valves with chain operators, to have enclosed

weatherproof gear operator. All valves certified suitable for dead end service with no downstream flange. Nibco LD-2000

G. MISCELLANEOUS VALVES: As indicated on the Drawings.

H. INSULATION PROVISIONS: Valves on insulated lines shall have stems extending through insulation. Plug valves shall have DeZurik 400 dry cap. All ball valves except heating water valves shall have Nibco Nibseal system installed.

I. INSTALLATION: Ball valves shall be installed such that handle for valve is positioned on the side of the pipe and is pulled down to close the valve.

J. ACCEPTABLE MANUFACTURERS: Apollo, Crane, De Zurik, Hammond, Grinnell, Nibco and Stockham

2.2 STRAINERS

A. STRAINERS: Iron body, Y pattern basket type, line size with a 20 mesh Monel screen unless indicated otherwise. Size for a maximum of 2 PSIG pressure drop. Provide ball valve with hose end to blow-off on strainers. Chilled and hot water strainer baskets to have 1/16" perforations. Condenser water strainer baskets to have 1/8" perforations.

B. SUCTION DIFFUSERS: Flanged type with strainer area five times suction area, straightening vanes with length 2½ times suction diameter, magnetic insert, reducing flange as required and adjustable floor support. All internal parts shall be replaceable.

C. ACCEPTABLE MANUFACTURERS: Keckley and Taco

2.3 WATER SPECIALTIES

A. GENERAL: Provide all specialties necessary for proper operation of the water systems. Install manual air vents at all high points on chilled and hot water lines and automatic vents where shown. Install T&P relief valves in all closed water piping systems.

B. TEMPERATURE AND PRESSURE RELIEF VALVES: ASME labeled with try handle. Discharge pressure rating shall be approximately 10 PSI above normal maximum system operating pressure; except valves on hot water boilers to be rated at 30 PSI. Valve shall have a capacity not less than rated output of boiler.

C. BLADDER EXPANSION TANKS: 125 PSI rated, captive air type with charging valve and replaceable bladder designed for 100% acceptance.

D. AUTOMATIC AIR VENTS: Bell & Gossett No. 107A high capacity vent, 150 psi rating, with shut-off cock. Install 1/2" copper tube overflow line extended to a suitable drain point.

E. MANUAL AIR VENTS: 1/2” ball valve with plug.

F. AIR SEPARATORS / AIR AND DIRT ELIMINATORS: Shall have tangential inlet and outlet connections, top tank fitting, PALL ring technology, drain/blow down valve and be constructed to ASME applicable codes for 125 PSIG working pressure. Taco Model 4900-AD

G. AIR DIRT ELIMINATION / DECOUPLER: Shall have tangential inlet and outlet connections, top tank fitting, PALL ring technology, drain/blow down valve and be constructed to ASME applicable codes for 125 PSIG working pressure. Unit shall provide hydraulic bridge between primary and secondary pumping systems. Taco Model 5900 Plus

H. PRESSURE REDUCING VALVE: 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.

I. ACCEPTABLE MANUFACTURERS: Aurora, Bell & Gossett, Keckley, McDonnell-Miller, Taco, Thrush and Wood Industrial Products.

J. TEST PLUGS: Provide Pete's Plugs or Texas Fairfax test plugs at inlet and outlet of each pump, AHU water coil, strainer, control valve and chiller cooler and condenser bundle. Provide extension where piping is insulated. Provide two sets of temperature and pressure gages for use with the Pete's Plugs. Gages to be of appropriate scale for system measurements.

K. GAGES: 4½" dial diameter, bottom connected, flangeless, moisture and dust proof case with blowout plug, screw rings and glass crystal. Movement shall be silicone dampened, bronze brushed rotary movement. Pressure range 0 to 150% of system working pressure. Provide brass “T” handle shut off cock for each gage with minimum rating same as gage. Acceptable Manufacturers: Ashcroft, Marsh, Marshalltown, Scientific, Trerice, Weiss or Weksler.

L. THERMOMETERS: Outdoor thermometers shall be cast brass or cast aluminum case with brass separable sockets (with extension neck for insulated piping); red reading non-Mercury type with 9" scale for maximum and minimum temperature to be encountered. Chilled and condenser water range to be 30° F to 130° F, 2° divisions. Hot water range shall be 30° F to 240° F, 2° F divisions. For thermometers at or below 6 feet high, install scale vertical. For thermometers above 6 feet high provide adjustable angle type. Install scale at 45° facing down for easy reading. Weiss Model 9VU35. Equal thermometers by American, Marshalltown, Scientific, Taylor, Trerice and Weksler are acceptable.

M. THERMOMETER WELLS: Weksler Test Wells, brass with 3½" stem, 2½" extension neck, and brass screw plug, or comparable models made by American, Marshalltown, Scientific, Taylor, Trerice or Weiss.

END OF SECTION

SECTION 23 21 23

HYDRONIC PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - EQUIPMENT

2.1 END SUCTION WATER PUMPS

A. GENERAL: Pumps shall be base mounted with flexible coupling. End suction pumps shall be back pullout type with cast support from the casing.

B. CONSTRUCTION: Pumps shall be bronze fitted with iron or steel casing, casing wearing ring, shaft sleeve, drip proof motor, cast iron or steel base, coupling guard, grease fittings and mechanical shaft seals. Impeller shall be statically and dynamically balanced and shall not be larger than 85% of cutwater size. Motor to pump connection shall use Wood's Dura-Flex coupling with 1.5 service factor suitable for variable speed drive applications.

C. CAPACITY: Capacity as scheduled on Drawings. Include cost of re-trimming impeller if required to properly balance the system.

D. MOTOR: Construction and selection shall be non-overloading at selection point and at any point on the curve. Service factor may be used for meeting this requirement except at selection point. See Motors in Section 23 05 00.

E. VFD: For pumps noted to have an integral VFD, the VFD shall conform to the specifications for VFDs in another Division 23 29 00 – Low Voltage Controllers.

F. ACCEPTABLE MANUFACTURERS: Taco, Armstrong, Aurora, Bell and Gossett, and Grundfos.

2.2 VERTICAL INLINE PUMPS (HWP-1 & 2)

A. GENERAL: Pump shall be self-sensing, close coupled, mechanical sealed inline pump. Pump shall be equipped with a programmable pump interface.

B. CONSTRUCTION: Pumps shall be constructed of Ductile Iron for closed loop hydronic heating and cooling systems. Stainless steel shaft, sealed ball bearing, PPS Impeller. Type 2 (IP44) enclosed motor. Integrated motor protection. UI778 listed.

C. CAPACITY: Capacity as scheduled on Drawings. Include cost of re-trimming impeller if required to properly balance the system.

D. MOTOR: Electronically commutated (EC) with an integrated frequency drive.

E. ACCEPTABLE MANUFACTURERS: Taco, Armstrong, Aurora, Bell and Gossett, and Grundfos.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 GENERAL REQUIREMENTS

A. Construct all piping systems in accordance with applicable ASME and ASTM Codes.

B. Piping shall be installed in a neat and orderly manner parallel to building coordinates with vertical drops. Piping in the vicinity of equipment shall be arranged to not interfere with access panels and maintenance space.

C. All piping, fittings, and valves shall be manufactured in the United States of America.

PART 2 - MATERIALS AND METHODS

2.1 REFRIGERANT PIPING

A. GENERAL: Submit shop drawing of piping system showing all traps, pipe sizes, and accessories. Drawing to be marked "Approved", and signed by an employee of the Application Engineering Department of the manufacturer of the equipment being served. Do not install piping until this drawing is submitted and approved.

B. MATERIALS:
1. PIPE: Type "L" copper ACR tubing.
2. FITTINGS: Wrought copper streamlined, long radius sweat fitting.
3. SOLDER: Sil-Fos, except on valves use solder recommended by valve Manufacturer. Make joints while pipe is under nitrogen purge to prevent formation of oxides inside piping.

C. ACCESSORIES: Install replaceable core type liquid line dryer-strainer sized for system capacity at 2 PSI pressure drop per ARI Standard 710-64, sight glass-moisture indicator, expansion valves, solenoid valves and charging fittings. Provide supports made for copper refrigerant piping.

END OF SECTION

SECTION 23 25 13

WATER TREATMENT FOR CLOSED HYDRONIC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 CLOSED SYSTEM WATER TREATMENT

A. GENERAL: Contractor shall clean and flush chilled and heating water systems. After cleaning, fill with clean, treated water per this specification.

B. EQUIPMENT: Provide Vector Industries Model FA 900 filter feeder with legs and stainless steel sock enclosure, drain valve, ball type shut-off valves, 50 micron filter and flow indicator and necessary accessories for the chilled and heating water systems. Unit for heating water system shall be suitable for 240° F water temperature. Pipe filter feeders across the system pumps. Flow rate through filter feeder shall be adjusted to equal 1% of system flow.

C. CLEANING METHOD AND WATER TREATMENT CHEMICALS:
1. General Procedure: The chilled and hot water systems shall be flushed and all debris, rags and foreign objects from construction shall be removed from equipment, traps, etc. System drains shall be located at low points and preferably as far from the fill point as practical. Drain valves shall be minimum 3/4” ball valves. Do not use hose bibbs as drain valves. When system is being cleaned and flushed, do not circulate water through coils, control valves or flow control valves. Install temporary by-pass hoses between isolating and balancing valves at coils to allow re-circulation. Install temporary spool pieces at control valve locations in mains during the flushing and cleaning process. Temporarily 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. Strainers at coils only shall be removed until flushing is complete. Strainers at pumps shall remain in place to protect pumps and equipment. Clean strainers frequently during the circulation process. When flushing and cleaning is finished, complete piping connections. Remove temporary hoses and spool pieces, install strainers or strainer elements. When systems are refilled with clean water, circulate that water for 24 hours, then clean and re-install strainers or strainer elements.
2. Phase 1 - Initial Flushing of the System: Remove loose dirt, mill scale, weld heads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush system until “potable water clear” and particles larger than 5 microns are removed. Dispose of water in an approved manner.
3. Phase 2 - Cleaning of the Piping System: Remove without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil grease (hydrocarbons), welding and soldering flux, mill varnish, piping components, rust (iron oxide) and other deleterious substances not removed by initial flushing. A solution of Allegheny BC88 liquid piping cleaner shall be circulated in the system for a minimum of 48 hours according to a procedure recommended by the chemical company. Dosage: 5

gallons per 1000 gallon system water. After circulating cleaner solution, drain system as fast as possible to remove suspended solids. Dispose of water in an approved manner.

4. Phase 3 - Refill system, and circulate clean water for a minimum 24 hours with a constant bleed off drain/refill rate of approximately 6 gpm to flush remaining solids. Operate valves to dislodge any debris in valve body. Flush system until “potable water clear” and particles larger than 5 microns are removed.
5. Submit status report upon completion of each phase of work on each system. Owner’s representative shall be present to observe cleaning of piping systems at each phase.
6. After ensuring the system water is clean, add Allegheny CST375 corrosion inhibitor through pot feeders to leave closed systems in proper pH condition. Leave system at 1 gallon per 1000 gallons of water concentration. Circulate water with all control valves open for 24 hours to ensure proper mixing.
7. The system water at final inspection will be certified in writing as to cleanliness and final treatment by the water treatment supplier to the Mechanical Contractor.

D. ACCEPTABLE WATER TREATMENT COMPANIES: Worth Hydrochem, only.

END OF SECTION

SECTION 23 29 00

LOW-VOLTAGE CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 VARIABLE SPEED MOTOR CONTROLLER (VFDs)

A. GENERAL: Controller shall be a microprocessor controlled, adjustable frequency motor controller consisting of a sine-coded, pulse width modulated output inverter suitable for specified size and voltage motors listed on the Drawings. Unit shall be U. L. Listed as a complete package and comply with the applicable ANSI, IEEE and NEMA Standards as well as the National Electrical Code. Inverter shall be grounded, and line, load, control, and fire/safety wiring shall be installed in separate conduits.

B. DIMENSIONS: VFD module shall have a minimum 2:1 height- to-width ratio.

C. FEATURES:

01 Two contactor style, three leg manual bypass contactors with H-O-A switch and lockable motor rated switch or lockable molded case switch per NEC Article 430. Bypass section shall be in a separate enclosure from the inverter and circuited to allow operation with all power disconnected from the inverter section. Protective controls shall operate in both normal and by-pass modes.

02 NEMA 1, wall mounted enclosure with a maximum width on 10” the 1 thru 60Hp, 460V and 30” on the 75 – 200Hp, 460V.

03 Digital keypad with LCD screen for entry of set points

04 Panel mounted start-stop control as well as 0-10 VDC and 4-20 ma interface to standard energy management systems.

05 Unit shall operate normally with input up to 30% over voltage and 35% under voltage

06 Inherent power factor correction to .95.

07 Field adjustable acceleration and deceleration times.

08 0-120 Hz controlled speed range with adjustable maximum and minimum stops. For direct drive motors set maximum speed per the equipment submittal requirements.

09 Safe shutdown and immediate restart after a power outage.

10 3% input (line) reactors and DC Bus filtered chokes matched to motor size to reduce harmonics emitted to electrical system and limit voltage spikes to motor and drive.

11 MOV's for transient voltage protection

12 Provide 115-volt control transformer to interface with vibration switches and other control devices.

13 Provide with integral disconnect with circuit breaker to protect VFD when in both normal and by-pass modes

D. PROTECTIVE CONTROLS (both automatic and bypass):

01 Overvoltage and undervoltage.

02 Ground fault.

03 Phase loss or failure.

E. NAMEPLATES: Identify each VFD with an engraved nameplate showing load served and the maximum horsepower rating.

F. AUXILIARY CONTACTS:

01 VFD shall include auxiliary NC and NO contacts for use in controlling associated dampers or actuators.

02 Provide integral 24V transformer for use in powering interlocked actuators.

G. STARTUP: A factory trained service technician shall startup and test each drive. Technician shall contact Engineer prior to startup to obtain special settings that may be required for primary pumps, cooling tower, direct drive air handling units and other equipment. Technician shall also operate drive through the frequency range and note any frequencies that cause resonance with the associated equipment. If directed by the engineer, lockout or skip those frequencies. Installer shall provide all necessary paperwork to obtain factory extended warranty.

H. SUBMITTALS: Provide complete information to confirm compliance. Also provide certified noise data showing that the drive does not exceed preferred "RC" as listed in 1995 ASHRAE HVAC Applications, Chapter 43 Sound and Vibration Control, Table 2 Criteria for Acceptable HVAC Noise in Unoccupied Rooms.

I. WARRANTY: 5 years, all inclusive with factory authorized start-up by Roessler Equipment.

J. ACCEPTABLE MANUFACTURES: ABB ACH580-VDR

2.2 MOTOR STARTERS

A. GENERAL: Provide an individual controller for each motor. Packaged type equipment such as rooftop units and chillers come with starters provided by the equipment manufacturer. Certain motors as noted on the Drawings require variable frequency drive.

B. ENCLOSURES: Provide NEMA 1 for standard installations and NEMA 4X Stainless Steel for installations outdoors, commercial kitchens and wet areas. Provide combination starter/disconnect switch where shown on the drawings.

C. AUTOMATIC STARTERS: Each starter component shall be sized in accordance with NEMA Standards. The minimum size starter shall be #1. Each unit shall be provided with a manual reset, adjustable electronic current sensing relay that protects for over-current, unbalanced current and phase loss. Provide for auxiliary contacts, including at least one spare NO set, required for interlock wiring. Provide individual 120-volt control transformers in each enclosure sized to operate coil and equipment related control and safety devices. Provide HOA switch and red LED running light. For small motors, ensure the appropriate trip unit is provided in the Size 1 starter so the sensed wire does not have to be double looped through the sensing coil.

D. POWER FACTOR CORRECTING CAPACITORS: Certain motors as noted on the Drawings shall have starters with integral power correction capacitors, selected to ensure a .95 or better power factor for the motor circuit.

E. AUXILIARY CONTACTS:

01 Starter shall include auxiliary NC and NO contacts for use in controlling associated dampers or actuators.

02 Provide integral 24V transformer for use in powering interlocked actuators.

F. NAMEPLATES: Identify each device with an engraved nameplate showing equipment served. Attach with two screws.

G. FINISH: Standard.

H. ACCEPTABLE MANUFACTURERS: Allen-Bradley, Cutler-Hammer, General Electric, Franklin, Siemens, and Square D

2.3 ELECTRONICALLY COMUTTATED MOTORS (ECMs)

A. GENERAL: Motor shall be brushless DC and utilize a permanent magnet rotor. The cycle rate shall be controlled by the motor module.

B. FEATURES:

01 Motor shall be capable of being controlled by BAS through 0-10V signal. (A dial on the side of the motor can bused to set the speed for system volume in constant volume applications.)

02 Motor has built in current overload, locked rotor, and thermal protection.

03 Provide with standard motor starter and separate disconnect.

END OF SECTION

SECTION 23 31 00

HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 SHEET METAL SHOP DRAWINGS

A. Submit Shop Drawings for all ductwork, showing coordination with fire sprinkler piping, and mechanical, electrical, plumbing, and structural components. The mechanical, electrical, plumbing, and fire sprinkler contractors shall sign off on the final coordination drawings. Do not fabricate any sheet metal prior to receiving an approved shop drawing from the engineer. The shop drawing shall include a construction details booklet and PDFs of the coordination drawings and the booklet. Comments and approval will be noted on the pdf's and returned. Contractor shall make copies of the approved shop drawing for his use in the field.

1.3 INSTALLATION OF DUCTWORK AND AIR DEVICES

A. Prior to all work under this section, carefully inspect the installed work of all other trades, and verify that all such work is complete to the point where fabrication and installation of the work of this section may properly commence.

B. Verify the installed location of all structural components, piping, conduit, and equipment is consistent with the coordination drawing. Verify that all ductwork with insulation will fit in the areas indicated on the coordination drawing and make any necessary adjustments prior to fabrication or installation of any ductwork.

C. The exact location of all registers, grilles or ceiling outlets shall be verified by the Architect before roughing-in. Refer to the Architect's reflected ceiling plan for locating ceiling outlets.

D. Ducts shall be installed in a neat and workmanlike manner.

1.4 CONNECTIONS TO LOUVERS

A. All connections to louvers shall be in a manner that will be watertight. Ductwork behind louver for a minimum of three feet shall have watertight, soldered joints and shall be sloped to weep holes in bottom of louver. Duct shall be lapped over bottom louver blade where possible. Make connections to aluminum louvers with dielectric connections.

1.5 ADJUSTMENTS AND CORRECTIONS

A. Balance all systems of ductwork including exhaust systems to obtain the air quantities indicated for each inlet and outlet within ±10%. Air quantities shall be further adjusted as required to obtain uniform temperatures in the spaces.

PART 2 - MATERIALS AND METHODS

2.1 LOW PRESSURE DUCTWORK

A. Furnish and install all supply, return, exhaust, outside air, and other ductwork shown complete with splitters, extractors, dampers, and other required devices. All ductwork, supports, and bracing shall be constructed of new grade, lock forming quality, G-60 or better galvanized steel sheets. All ductwork sheet metal shall be made in the United States of America.

B. Dimensions of duct work shown on Drawings are inside air stream dimensions. Allowances have not been made for internal duct insulation. Provide equivalent sized duct of different aspect ratio to accommodate ceiling cavity conditions.

C. Provide balancing OBD in each zone duct of multi-zone AHUs. Provide 45° conical tap with damper and raised quadrant lock for supply duct taps, reference detail on the Drawings. Conical taps shall not be spin-in type. Provide adjustable round elbows (0-90°) at ceiling devices connected with flex ducts to prevent collapse of the flex at connection unless Flexmaster self-supporting flex is installed.

D. Ductwork shall conform to current edition of SMACNA "Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning System" and the National Board of Fire Underwriters Pamphlet 90A, plus more stringent requirements of these Specifications. Adjust location of standing seams to clear structural members.

E. Duct connections to air handling units and fans shall match the outlet/inlet size, or as recommended by the equipment manufacture, including straight lengths of duct before transitions, to minimize system effect losses. Where duct adapters or damper trays are provided with roof fans, duct connections shall match size for a minimum of 36” before elbow or transition.

F. All duct transitions shall be gradual with a 15° maximum angle as measured from centerline of duct. This includes angled offset, mitered offset, eccentric transition and concentric transition (2 x 15°).

G. Ductwork shall be constructed to operate at the design system pressure. Generally, ductwork shall be constructed for 2” static pressure. Ductwork downstream of VAV boxes, fan coil units and fans may be 1” static class ductwork. Primary ductwork from a variable air volume air handling unit supplying terminal boxes shall be constructed in accordance with Section 2.2 Medium Pressure Ductwork.

H. Square turns shall be equipped with airfoil turning vanes built to SMACNA Standards. Provide radius turns for elbows less than 90°.

I. DUCTWORK SUPPORTS: Support ductwork with 1" wide x 20 gage galvanized steel straps spaced 6'-0" maximum centers but not more than allowed by SMACNA. Connect strap to duct with two sheet metal screws on each side of duct and one on bottom. Exposed ducts shall be supported in a manner to provide a finished appearance.

J. Seal all duct joints, adjustable elbows, flanged taps and any penetrations of the duct such as screws with Foster 32-19, Childers CP-146, Design Polymerics DP1010 or Hardcast IG601 Iron Grip installed full strength (no dilution). Ductwork subject to moisture (indoors) and not required to be welded, shall be sealed with Foster 32-14 or Childers CP-140.

K. Flexible duct shall be U. L. Listed 181 Class I air duct with CPE inner liner, fiberglass insulation with a C=.23, bi-directional reinforced metalized vapor barrier outer jacket and 10" w.c. pressure rating. The insulating value shall be meet the International Energy Code, minimum R=6. The maximum length between duct and air device shall be six feet. The maximum length between duct and single or double duct mixing box shall be three feet. Flexmaster Type 1M or Thermaflex M-KE. Connect inner liner to duct tap, VAV box, round rigid duct or air device with stainless steel, adjustable bands (hose clamps). Secure outer cover with nylon wire tie strap. Tape edges of outer cover to adjacent insulation or duct with FSK foil tape to present a finished appearance.

L. For exposed ducts and in other areas noted to have round double wall ductwork, provide United McGill Acousti-K27. Outer duct shall be constructed of paintable, 18-gauge galvanized steel. Inner duct shall be perforated galvanized steel. Between the inner and outer ducts install 2” thick fiberglass insulation coated to inhibit growth of micro-biological organisms and to eliminate erosion of fibers.

M. For welding exhaust or dust collector duct, provide round, spiral wound duct, minimum 18 gauge. All ductwork, fittings and accessories for a complete system shall be included in the project. All elbows shall have 2½ diameter centerline radiuses. Branch connections shall be Y fittings.

N. The minimum distance between the CVT/VAV box and the first tap shall be 54". The minimum distance between taps on the same side of the duct shall be 54".

O. Sheet metal contractor shall install control system devices that are attached to ductwork. This includes control dampers and sensors.

P. Provide access doors for cleaning ductwork before and after coils, filters, fans and dampers. Locate doors so that the minimum numbers possible are used. Provide removable end caps on ducts.

2.2 MEDIUM PRESSURE DUCTWORK

A. Furnish and install medium pressure round and oval ducts that connect VAV medium pressure AHU's and their associated VAV/CVT boxes as indicated on the Drawings. All ducts shall be sized as indicated on the Drawings, and properly supported and hung from the building structure by trapeze hangers. The minimum size hanger rod shall be 3/8". All ductwork shall be externally insulated per the Specifications. All turning vanes shall be heavy gage, double thickness type.

B. Medium pressure round or oval duct shall be spiral lock seam duct as manufactured by Gowco, Graco, or United Sheet Metal with matching factory-made fittings and couplings. All transitions shall be gradual with a 15° maximum angle with centerline of the duct. All joints and fittings shall be spot-welded and sealed.

C. Gauges of round medium pressure ducts shall be as follows:

3" thru 8"	26 gauge
9" thru 22"	24 gauge
24" thru 36"	22 gauge
38" thru 50"	20 gauge
52" thru 60"	18 gauge

D. Gauges of flat oval spiral ducts shall be 22 gauge up to 48" major axis and 20 gauge from 49" thru 74" major axis. Fittings shall be 20 gauge up to 36" major axis, 18 gauge for 37" thru 50" and 16 gauge for 51" and larger major axis. Centerline radius of elbows shall be 1½ duct diameters. Provide conical take-offs where possible.

E. Fittings and couplings thru 36" shall be 22 gauge, 38" thru 60" shall be 20 gauge.

F. All square to round/oval transitions at air handling unit discharges shall be 18-gauge galvanized steel with all welded connections, and shall have flanged rectangular connection.

G. All joints in ducts and fittings shall be sealed with United Sheet Metal High Pressure Unigrip duct sealer, Childers CP-140 or Foster No. 32-14.

H. Connections to fan powered boxes from main duct to box extension shall be made with a two-foot length of straight flexible connecting duct. This flexible duct shall be Flexible Tubing Corporation Thermaflex, insulated Type M-KC, U. L. approved. Provide a hard, straight section of round duct at VAV box connections with length 1½ times duct diameter. Connect inner liner to duct tap, VAV box, round rigid duct or air device with stainless steel, adjustable bands (hose clamps). Secure outer cover with nylon wire tie strap.

I. SUPPORTS: Ductwork supports shall consist of Unistrut with 3/8" thick or heavier all thread rods attached to structure. Provide double nuts and cut all tread so no more than 1" extends beyond nut.

J. Access panels shall be Nailor Industries Model 0800-M1 insulated access panels with camlocks and safety chain. Provide 18" x 10" size approximately 20 feet on center.

2.3 SHOWER EXHAUST DUCTWORK

A. Duct material shall be 18-gauge, Type 316L stainless steel, watertight construction with external welded joints, from intake grilles to exhaust fan. Slope duct to drain through ceiling grilles when fan is off.

2.4 FUME HOOD DUCTWORK AND OTHER DUCTWORK NOTED TO BE STAINLESS STEEL

A. Duct material shall be 18-gauge, Type 316L stainless steel, watertight construction with external welded joints.

2.5 DUCTWORK FOR OUTSIDE AIR HOODS AND FANS

A. Where hoods or fans are shown open to mechanical room, shop, and similar locations, provide a short length of duct to allow installation of OBD and/or motorized control damper. Duct dimension shall be roof curb opening size or larger if required by damper size.

2.6 PLENUMS AND BLANK-OFF PLATES

A. Provide plenums at louvers, air handling units, fan coil units and other equipment where return air or outside air ducts are shown to connect. Provide plenums for the mounting fans to louvers. Provide full or partial blank-off plates on return air openings as necessary for properly balancing of system supply air, outside air and return air flows or to cover openings where air transfer is not desired. Plenums shall be 12” unless noted to be larger.

B. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross broken or rigidly braced with galvanized angles. Gages and bracing shall conform to SMACNA recommendations for ductwork of like size. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.

C. Where access doors are shown, provide hinged doors with #202 Ventlok latch.

2.7 DRYER EXHAUST DUCTWORK

A. Provide snap lock, round galvanized sheet metal with taped, slip-fit joints. Minimum 26 gage. Eliminate edges and sheet metal screws that could catch lint. Use duct tape or pop-rivets on all seams and joints.

B. Install flexible connections of fire-resistant material with spiral inner liner wire, stainless steel clamps between unit and exhaust duct.

C. Provide residential style dampered and hooded wall outlet for discharges through walls. Roof discharge cap shall have baffled outlet, without bird screen similar to Penn Pul-Air.

D. Where dryer vent duct is to be installed in space behind sheetrock wall, provide Retrofit Dryerbox Model: RB-400 at back of dryer.

2.8 SCREENS

A. Furnish and install screen on all duct and fan openings which lead to or are outdoors. Screens shall be No. 16 gage, galvanized steel 1/2" mesh bolted into removable galvanized steel frame. Install screens over return air openings between floors.

2.9 WALL AND FLOOR PENETRATIONS

A. GENERAL: Duct and return air opening penetrations of floors and fire rated walls shall have fire dampers installed per their listing.

B. MATERIALS: Gage of sleeves shall be as required by the conditions of U. L. listing, but not less than the gage of duct. Minimum 18 gage. Install 1½" x 1½" x 1/8" angles around duct on both sides of wall or floor penetration.

C. WATER BARRIER: Build 3" high by 3" wide concrete "dam" around duct or return air penetrations of mechanical room floors above grade. Floor return air openings without sound attenuator attached shall be covered with 1" x 1/8" welded steel bar grating supported by 2" x 2" x 1/4" angles attached to slab with 3/4" round drilled anchors, 24" on center.

2.10 SADDLES

A. Provide sheet metal protective saddles at all pipe supports for insulated piping. Refer to Insulation Section.

2.11 DRAIN PANS

A. GENERAL: Provide drain pan under fan coil units, air handling units, water heaters, and other equipment subject to water leakage not mounted on concrete floor in mechanical room.

B. CONSTRUCTION: 16-gauge 304/316 stainless steel suitably stiffened, with minimum 2" perimeter lip and all joints soldered watertight. Provide connection and overflow drain to suitable location.

PART 3 - TESTING

3.1 LOW PRESSURE DUCTWORK

A. Completed duct system including taps shall be tested at 1.5 times scheduled ESP, or 1” for ductwork downstream of terminal boxes. Leakage shall not exceed 1% of the total designed CFM for the individual duct system being tested.

3.2 MEDIUM PRESSURE DUCTWORK

A. Completed duct system (taps and access panels installed) shall be tested at 5” water column at which pressure leakage shall not exceed 3/4 of 1% of the total designed CFM for the individual duct system being tested.

3.3 ADDITIONAL REQUIREMENTS:

A. All testing shall be performed by the mechanical contractor and witnessed by the Owner’s TAB firm, an Owner’s representative and Engineer.

B. Records for measured duct leakage shall be kept and included in the project close out binder.

END OF SECTION

SECTION 23 33 00

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 DAMPERS

A. GENERAL: Provide dampers where shown on Drawings and as necessary to control air flow in all supply and outside air ducts. Provide multi-blade volume dampers in all zone ducts of multi-zone air handling units. Provide access doors in sheetrock ceilings to all access to damper operators.

B. SPLITTER DAMPERS: Shall be constructed of single thickness, 16-gauge galvanized steel, hinged at leaving edge and founded at entering edge, securely riveted, or welded to a square operating rod. The length of the splitter damper blade shall be 1½ times the width of the split in the main duct, but not less than 12".

C. VOLUME DAMPERS: Factory constructed of 16-gauge galvanized steel for frame and blades. Blades shall not exceed 48" in length or 6" in width and shall be of the opposed interlocking type. The blades shall be supported on 1/2" diameter rust-proofed axles. Axle bearings shall be self-lubricating ferrule type.

D. FLEX TAP CONNECTIONS: Taps on rectangular low-pressure ducts for flexible connections to diffusers shall be 22 gauge, round conical taps with adjustable single blade damper. Damper rod shall be continuous though tap with blade mechanically attached. Provide bearings at each end, and quadrant lock operator with wingnut and 2” standoff bracket for insulation. Refer to detail on the drawings for additional construction details. Spin-in taps are not allowed.

E. DAMPER ADJUSTING DEVICES: Each splitter or volume damper shall be fitted with an adjusting device extending beyond external duct insulation.
   1. ACCESSIBLE CEILINGS: Duro-Dyne Universal Economy Standoff regulators attached directly to duct and location marked in ceiling as approved.

2.2 FIRE DAMPERS (NON-POWERED)

A. GENERAL: Install fire dampers in all duct penetrations and return air openings in fire rated walls, ceilings, floors, and chases. Provide fire damper at each sidewall register or grille. Provide additional fire dampers where specified by local building codes and shown on drawings.

B. DUCT DAMPERS: Construction shall conform to requirements of NFPA Pamphlet No. 90A with recommended steel sleeves and fusible links. Dampers shall be U. L. labeled. Fire dampers shall be shutter type providing minimum restriction to air flow. Provide Type B for ducts passing through walls. Provide thin line Type A dampers at sidewall registers. Select damper thickness to fit within the thickness

of the wall with OBD's or other specified devices. Dampers located in medium pressure ducts shall be compatible with this construction including the specified maximum leakage rate. Install dampers in accordance with conditions of their U. L. listing.

C. CEILING DAMPERS: Air devices in U. L. fire rated ceilings shall have compatible U. L. classified ceiling dampers with volume adjustment mechanism and extension collar equal to Ruskin CFD-A. Install complete system including thermal blanket on back of air device in accordance with the U. L. listing.

D. ACCEPTABLE MANUFACTURERS: Greenheck, Nailor, Pottoroff, Ruskin, and Safe-Air

2.3 SMOKE DAMPERS (POWERED)

A. GENERAL: Dampers shall be 1½ hour fire rated under U. L. Standard 555S. Dampers shall be normally closed with a leakage rate of no more than 10 CFM per square foot at 1" static pressure (Class II). Install in accordance with the U. L. Listing including duct sleeve. Damper blades shall be airfoil type for low pressure drop and low noise when in the open position.

B. OPERATOR: Damper operator shall respond to remote signals to open and close and shall fail in the closed position. Damper operator shall be 120 volts unless noted otherwise. Provide micro-switches to signal full open and full closed positions.

C. COMBINATION DAMPERS: Dampers noted to be combination smoke and fire shall have fusible link assembly to close damper on elevated temperature.

D. ACCEPTABLE MANUFACTURERS: Smoke dampers shall be Nailor Model 1211. Combination dampers shall be Nailor Model 1221. Equivalent dampers by Greenheck, Pottoroff, Ruskin, and Safe-Air are acceptable.

2.4 ACCESS DOORS TO FIRE AND SMOKE DAMPERS

A. GENERAL: Provide double wall galvanized steel, insulated access door in duct for inspection and service to fire damper and fusible link. Minimum size shall be 16"x16" with four cam latches unless limited by duct size. Access doors in stainless steel ducts shall be constructed of stainless steel.

B. CONSTRUCTION: Construct access door airtight and conform to recommendations of NFPA and SMACNA.

C. INSTALLATION: Opening of access panel shall be within 12” of the damper to allow resetting of the actuator.

2.5 FLEXIBLE DUCT

A. GENERAL: Flexible duct shall be U. L. Listed 181 Class I air duct with fiberglass/aluminum foil inner liner, fiberglass insulation with a maximum C-value of .167. Black, fire retardant, Polyethylene vapor barrier outer jacket with excellent strength at low temperatures and will not age harden.” The insulating value shall be meet the International Energy Code, minimum R=6.

B. INSTALLATION: The maximum length between duct and air device shall be six feet. The maximum length between duct and single or double duct mixing box shall be three feet. Connect inner liner to duct tap, VAV box, round rigid duct or air device with stainless steel, adjustable bands (hose clamps). Secure outer cover with nylon wire tie strap. Tape edges of outer cover to adjacent insulation or duct with FSK foil tape to present a finished appearance.

C. ACCEPTABLE MANUFACTURES: Flexmaster Type 3M, Flexmaster Type 3B or Thermaflex M-KE

2.6 FLEXIBLE CONNECTIONS BETWEEN AHU, VAV BOX OR FAN AND DUCTWORK

A. CONSTRUCTION: Flexible connections shall be made from neoprene coated, woven glass fiber material, 30 ounces per square yard.

B. INSTALLATION: Installed airtight with at least 1" slack to ensure that no vibration is transmitted from fan to ductwork. Air handling units with fans that are internally isolated from the housing do not require flexible connections.

2.7 ACOUSTICAL LINER

A. GENERAL: Provide 1" thick acoustical lining in return air ducts and return air plenums. Do not install in any supply air duct or kitchen return air duct.

B. MATERIAL: Owens-Corning "Aeroflex Duct Liner" or equivalent by CertainTeed; 1½ pound per cubic foot density, neoprene faced, "K" value shall not exceed .27 at 75° F mean temperature difference.

C. INSTALLATION: Adhere liner, with coated side toward air stream, to all interior sides of duct with 100% coverage of Foster 85-11. Further secure the liner with mechanical fasteners on maximum 12" centers. All edges and fasteners shall be coated with one brush coat of Foster 30-35.

D. PLENUMS: Plenum interiors exposed to view through louvers and grilles shall be lined and have pins painted flat black.

2.8 SOUND ATTENUATORS

A. GENERAL: Basis of specification is the United McGill Type UTLER. Unit shall consist of 22-gauge, galvanized steel outer shell with 24-gauge galvanized steel, die stamped internal passages. Acoustical filler shall be fiberglass compressed to 4.5 pcf density enclosed in an erosion resistant polymer bag.

B. ATTENUATION: Sound attenuation shall be within 5% of that listed below at 1000 FPM face velocity:

Octave Band	2	3	4	5	6	7	8
36" long insertion loss, dB	4	5	7	12	14	14	11
60" long insertion loss, dB	8	8	12	20	22	21	16
84" long insertion loss, dB	11	15	21	30	32	27	19

C. PRESSURE DROP: Silencer design must limit pressure drop to .1 in.w.g. based on 1000 feet per minute face velocity.

D. INSTALLATION: Attenuators shall be installed in galvanized sheet metal wall sleeve and sealed with duct sealant to prevent air leakage.

E. ACCEPTABLE MANUFACTURERS: AeroSonics, Anemostat, Buensod, Commercial Acoustics, IAC, Koppers, Rink, Dynasonics, United McGill and Vibro-Acoustics.

2.9 LOUVER MOUNTED BACK DRAFT DAMPER

A. GENERAL: Interlocked, multi-blade damper in rigid frame suitable for the size specified.

B. FRAME: 16-gauge galvanized steel.

C. BLADES: 16-gauge aluminum not to exceed 10" width, securely attached to 1/2" diameter, full length axles. Blades in each section shall be interlocked and have adjustable, counterweight system.

D. BEARINGS: Permanently lubricated ball bearings.

E. ACCEPTABLE MANUFACTURERS: American Warming and Ventilator Company Model BD-41 or equal by Arrow or Ruskin.

END OF SECTION

SECTION 23 34 00

HVAC FANS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - EQUIPMENT

2.1 ROOF FANS AND VENTS

A. GENERAL: Fans shall bear the AMCA seal of certified ratings for air and sound performance. Fans and their accessories shall be a prewired assembly from the factory for single point connection by the electrical subcontractor.

B. DESIGN: Fans shall be low silhouette type with removable top for easy access. Housings shall be constructed of heavy gauge aluminum. Kitchen fans shall have grease trough, discharge air vertically from a minimum of 40 inches above roof and be mounted on 18" high curb per NFPA 96, and shall be U. L. 762 Listed up to 400□ F. Power assemblies shall be completely removable as a unit for ease of service. Fans for fume hoods and prep rooms shall have acid resistant coating and explosion-proof construction.

C. DRIVE: Belt drive with heavy cast iron sheaves, adjustable drive sheave and adjustable motor plate. Centrifugal fans shall have motor out of the air stream, cooled by outside air.

D. FAN: Centrifugal fans shall have aluminum, backward curved, non-overloading wheel. Propeller fans shall be of heavy aluminum construction with a minimum of five blades set in a smooth venturi orifice.

E. ROOF CURBS: Mount on insulated, welded prefabricated aluminum roof curb (galvanized steel if on steel decking) with integral cant strip. Curbs shall be designed to mount fan level on sloped roof and be compatible with roof construction specified under the Architectural Sections of the Specifications. Provide duct adapter matched to supply air fans selected. Securely attach fans and hoods to curb with two bolts on each side. Bolt fan curb to structure.

F. ACCESSORIES: All fans shall have built-in thermal overloads, disconnect switch, and bird screen. Backdraft dampers shall be aluminum construction with nylon bushings. Relief hoods shall have adjustable gravity damper. Provide additional accessories as noted on the Drawings.

G. HOODS: Provide roof intakes and relief hoods of similar construction, features and installation as fans.

H. ACCEPTABLE MANUFACTURERS: Acme, Cook, Greenheck, Penn-Barry, S&P and Twin City

2.2 WALL FANS, PROPELLER

A. GENERAL: Propeller type, horizontal fan shaft, direct or belt driven, as indicated in schedule on Drawings. Fan blades shall be air-foil shape designed for high efficiency and low noise level. Blades shall be cast

with or welded to hub. Bearings shall have lubrication fittings. Unit shall have baked enamel paint finish. Fans and their accessories shall be a prewired assembly from the factory for single point connection by the electrical subcontractor.

B. MOTOR: Totally enclosed, continuous duty, ball bearing type. Single phase motors shall be permanent split capacitor type with built-in overload protection.

C. DRIVE: Belt drive units to have pillow block ball bearings, cast iron sheaves keyed to the shaft, belts rated at 120% of maximum BHP. Motor sheave shall be adjustable pitch type.

D. FAN PANEL: Minimum 16 gage steel construction with deep spun orifice and tubular bearing and motor supports welded into one rigid unit for maximum stability on belt drive units. Direct drive units 20" and smaller may have combination safety guard and motor support of cadmium plated welded wire with vibration isolators for fastening to fan panel on units 20" and smaller.

E. WALL BOX & GUARD: Belt drive units and direct drive units larger than 20" to be mounted in minimum 16 gage galvanized steel wall box with cadmium plated welded wire guard which shall be easily removed for servicing and shall comply with OSHA Standards. Drive side of fan shall face the safety guard for easy access and serviceability. Shutter shall be mounted a minimum of 7" from fan blade for 24"-30" units and 13" for 36"-72" units.

F. BACKDRAFT DAMPERS:
1. FOR EXHAUST FANS: Automatic type with rigid extruded aluminum frame, aluminum blades, aluminum shafts with nylon bushings, vinyl weather strips and counterbalances for easier opening. All shutters larger than 33" shall have rigid "T" section center member and double tie rods.
2. FOR SUPPLY FANS: Motor operated shutter of same construction with time delay relay to start fan motor after shutter is open.

G. GUARDS: Constructed of 1" x 1" mesh heavy gage, enamel coated welded wire or stainless steel.

H. ACCEPTABLE MANUFACTURERS: Cook, Acme, Greenheck, Penn-Barry, S&P, and Twin City

2.3 MISCELLANEOUS FANS

A. GENERAL: All fans shall be AMCA rated for air and sound. Each fan shall have fan blade and drive guards, disconnect switch and mounting isolators where applicable. Belt drive fans shall have adjustable motor base plates and adjustable cast iron drives sized for 150% of motor horsepower. Dampers shall be aluminum construction with stainless steel shafts and Teflon bushings. Fans and their accessories shall be a prewired assembly from the factory for single point connection by the electrical subcontractor.

B. FLY FAN: Unit shall have totally enclosed cabinet complete with wall mounting bracket, suitable for outdoor installation. Intake grille shall be adjustable for air quantity control. Discharge nozzles shall provide air pattern adjustment. Direct drive motor shall be resilient mounted and drive twin squirrel cage blower wheels. Unit shall provide a minimum of 1600 FPM at three feet from floor and conform with USDA Specifications. Provide door switch for automatic operation. Mars Model 48CH.

C. CEILING CABINET FANS: Fan designed for quiet operation suitable for ceiling mounting with integral white steel intake grille. Direct drive squirrel cage fan resiliently mounted. Provide solid state speed controller, backdraft damper, fire damper and internal fiberglass sound insulation.

D. UTILITY VENT SETS: Belt drive with inlet and discharge configuration as shown on the drawings. Fan wheel shall be backward inclined or airfoil type statically and dynamically balanced. Bearings shall be pillow block type with grease fittings and selected for 200,000 hour operation. Complete fan shall be phosphatized and painted with two coats of epoxy paint. Provide belt guard if mounted inside building, weatherproof cover if outside, drain connection, vibration isolators and inlet and outlet guards if not ducted.

E. ACCEPTABLE MANUFACTURERS: Acme, Cook, Greenheck, Penn-Barry, S&P and Twin City

2.4 INLINE FANS

A. GENERAL: Fan shall be UL 705 listed. All fans shall be AMCA rated for air and sound. Each fan shall have fan blade and drive guards, disconnect switch, and mounting isolators where applicable. Belt drive fans shall have adjustable motor base plates and adjustable cast iron drives sized for 150% of motor

horsepower. Dampers shall be aluminum construction with stainless steel shafts and Teflon bushings. Fans and their accessories shall be a prewired assembly from the factory for single point connection by the electrical subcontractor.

B. CONSTRUCTION: The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18-gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. For belt driven fans, pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging. Interior of housing shall be fiberglass insulated for sound attenuation. Provide automatic backdraft damper and fan installation hardware for application shown.

C. MOTOR (BELT OR DIRECT): Direct or belt drive as noted with fan wheel and motor assembly mounted on hinged side access panel. Motor shall be NEMA design B with a minimum of class B insulation rated for continuous duty and furnished at the specified voltage, phase, and enclosure.

D. MOTOR (DIRECT DRIVE-ELECTRONICALLY COMMUTATED): Motor shall be an electronically commutated motor rated for continuous duty and furnished either with internally mounted potentiometer speed controller or with leads for connection to 0-10 VDC external controller.

E. BEARINGS (SQNB): 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 cataloged operating speed.

F. BELTS AND DRIVES (SQNB): Belts shall be oil and heat resistant, static conducting. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

G. BASIS OF DESIGN: Cook SQNB or SQND

H. ACCEPTABLE MANUFACTURERS: Acme, Cook, Greenheck, Penn-Barry, S&P and Twin City

2.5 HIGH VELOCITY LOW SPIN (HVLS) FANS

A. GENERAL: Fan shall be UL 507 listed and IP47 Duty Rating. Data cabling shall be provided and installed under Division 23. Conduit for data cabling shall be provided and installed under Division 26 All fans shall be AMCA rated for air and sound.

B. CONSTRUCTION: Eight Anodized airfoils. Assembly mounted to joists.

C. MOTOR: Gearless direct drive, permanent magnet motor

CONTROLLER: Single wired controller shall control fans in pairs. Refer to floorplan for fan controller locations and interlocked fans.

D. WARRANTY:
1. 10-year mechanical warranty on airfoils and mounting
2. 10-year electrical warranty on motor, VSD, and controller/remote

E. ACCEPTABLE MANUFACTURERS: Big Ass Fans

F. For HVLS fans submitted that deviate from basis of design, any additional data cabling and controllers shall be provided and installed under Division 23. Additional conduit for data cabling shall be provided and installed under Division 26.

END OF SECTION

SECTION 23 36 00

AIR TERMINAL UNITS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 VARIABLE AIR VOLUME TERMINALS (VT, VAV, AND ET)

A. GENERAL: Box shall be a pressure independent, single input box. Maximum casing leakage shall be 2 percent at 3” inlet pressure. Boxes shall have the scheduled air flow at a maximum of .5" static pressure differential and an NC rating of 25 or less.

B. CONSTRUCTION: The assembly casing shall be constructed of not less than 20 gage galvanized steel, internally lined with 1", 1½ pound density fiberglass insulation meeting NFPA 90A requirements and UL 181 erosion requirements. Input connection shall be round or oval stub connections for flexible ducts. Outlet connections shall have S and Drive connection for sheet metal duct connection.

C. CONTROLS: Input shall be electronic operated. Damper shall position damper to normally open. Damper operator, control cards and transformers shall be provided by controls supplier, installed by box manufacturer. Controller shall maintain scheduled air flow within 5 percent, with static pressure variation between .5” to 2.0” w.g. Air flow sensor shall be aluminum, multi-point cross flow center averaging sensor with external taps for air flow readings with corresponding chart/label mounted on the box.

D. DAMPER: Damper blades shall be extruded aluminum or 20 gauge galvanized steel keyed to shaft and have a maximum leakage of 2% at 3" static pressure.

E. HEATING COIL: Hot water heating coil shall be minimum two row, copper tube, aluminum fin construction. Coil connection tubing shall 0.032” thick copper. Coil casing shall be constructed of 20 Ga. Galvanized steel. Coil tubing shall be ½” diameter, 0.016” thick copper. Aluminum fin shall be 0.0045” thick, ten (10) fins per inch, mechanically bonded tubing. Coil orientation shall match coil hand position shown on drawings.

F. SENSOR TYPE: Flow Tee or K4 LineaCross (Four Quadrant)

G. ATTENUATOR (AS SCHEDULED): Provide integral sound attenuator accessory. Attenuator section shall have 2” thick insulation.

H. ACCEPTABLE MANUFACTURERS: Krueger, Metalaire, Nailor, Price, and Titus

2.2 CONSTANT VOLUME TERMINAL UNIT (CVT)

A. GENERAL: Mixing box shall be pressure independent with up to 5” of inlet static pressure, single input box with built-in sound attenuator and constant volume fan. Fan shall operate at greater than 760 RPM. Boxes shall have the scheduled air flow at a maximum of .3" static pressure differential and an NC rating of 30 or less. Sound performance ratings shall be ARI certified. Provide recirculated air filter and hanger bracket with rubber isolator for hanger rods.

B. CONSTRUCTION: The assembly casing shall be constructed of 22 gage galvanized steel, internally lined with 3/4” closed cell, cleanable insulation.

C. CONTROLS: Air terminal unit shall have DDC controller supplied by the temperature controls contractor and mounted by the box manufacturer at its factory. Box supplier shall include cost of controller mounting in his bid. Unit shall be provided with electronic damper actuator, multi-point center averaging type velocity sensor, fan contactor, disconnect switch and minimum 50 VA 277V/24V control transformer (120V/24V if box is 120V). Inlet air sensor chamber shall contain straightening vanes or be of required length to obtain accurate readings.

D. CONTROL DAMPERS: Damper blades shall have a maximum leakage of 2% at 3" static pressure. Units shall have normally open dampers shipped in the full open position.

E. MOTORS: Air terminal unit shall include ECM motor and associated factory installed/set automatic adjusting controller with manual set point adjustment, with manual setpoint adjustment.

F. HEATING COIL: Hot water heating coil shall be minimum two row, copper tube, aluminum fin construction. Electric heaters shall be constructed per Electric Duct Heater Specification.

G. NON-SCHEDULED BOXES: Since the various brands of VAV boxes vary widely in size and shape, acceptable manufacturers who are not the brand specified on the Drawings shall ensure that their equipment will fit the available space prior to submitting a bid to the contractor.

H. ACCEPTABLE MANUFACTURERS: Nailor, Price and Titus

2.3 EXHAUST TERMINAL BOX

A. GENERAL: Box shall be a pressure independent, single input box and built-in sound attenuator. Maximum casing leakage shall be 2 percent at 3” inlet pressure. Boxes shall have the schedule air flow at a maximum of .5" static pressure differential and an NC rating of 25 or less.

END OF SECTION

SECTION 23 37 13

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements included in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 AIR DEVICES

A. Furnish and install louvers, supply, return and exhaust registers, grilles and outlets shown on the Drawings.

B. All devices shall be all aluminum construction and shall have white finish. Aluminized type corrosion resistant steel with finish having a five-year warranty against the formation of visible rust will also be acceptable. Devices in U. L. fire rated ceilings shall be of aluminized steel construction with white finish, suitable for U. L. classification.

C. All supply outlets shall be equipped with opposed blade volume dampers. Provide Titus Model D-75 for supply diffusers.

D. The air distribution equipment supplier shall guarantee that each supply, return and exhaust device shall be of the proper design and size to pass the indicated quantity of air into or out of the space involved, with maximum diffusion and without objectionable noise, excessive friction, or objectionable air movement at the occupied level.

E. Registers, grilles, and outlets shall be of manufacture, type and capacity as shown on the schedule of the Drawings. Similar devices of other manufacture may be submitted for approval for those items for which a reasonably close substitute is available. Devices must be similar in appearance and their style must be acceptable to the Architect.

F. If devices other than those shown are proposed, the values for their face velocities, neck velocities and noise levels, DBA or NC, shall not exceed these values for the devices scheduled on the Drawings.

G. Ceiling outlets shall be of a type compatible with the ceiling in which they are installed and shall have removable core with overlapping cone design to prevent vertical downward projection of air.

H. The contractor shall check the Architectural Drawings and verify the type of ceiling shown in the various areas to determine the proper type of outlet for the ceiling used.

I. Air devices in U. L. fire rated ceilings shall have compatible U. L. classified ceiling dampers with volume adjustment mechanism and have U. L. approved fireproofing on device. Dampers connected to flexible ducts shall also have extension collar feature equal to Ruskin CFD-A. Sidewall registers shall have thin line fire damper. Fire proofing devices shall contain no friable or fibrous material in the air stream.

J. Air diffusers not required to have fireproofing on the back of the diffuser shall be factory insulated suitable for return air plenum installation.

K. ACCEPTABLE MANUFACTURERS: Price, Titus, Krueger, Metalaire, Nailor,

2.2 LOUVERS

A. Furnish and install louvers shown on the Drawings.

B. All devices shall be all aluminum construction and shall have white finish. Aluminized type corrosion resistant steel with finish having a five-year warranty against the formation of visible rust will also be acceptable. Devices in U. L. fire rated ceilings shall be of aluminized steel construction with white finish, suitable for U. L. classification.

C. All louvers installed on the exterior of the building shall comply with AMCA 550 standard for water permeability.

D. All louvers installed on the exterior of the building shall comply with AMCA 540 standards for impact rating.

2.3 RELIEF & INTAKE VENTS

A. Furnish and install relief and intake shown on the Drawings.

B. All devices shall be

C. ACCEPTABLE MANUFACTURERS: Cook, Greenheck, Krueger, Metalaire, Nailor,

2.4 RESIDENTIAL DRYER WALL VENT

A. Furnish and install dryer wall vent as shown on the Drawings.

B. Vent assembly shall be constructed of heavy gauge Galvalume and powder coated steel body.

C. Dryer wall vent assembly shall include:
1. Built-in drip edge
2. Gravity assisted, lightweight Galvalume damper
3. Integrated magnets to deter bird and rodent intrusion

END OF SECTION

SECTION 23 37 16

FABRIC DUCT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 FABRIC DUCT AIR DISTRIBUTION SYSTEM

A. Provide fabric duct air distribution as shown on the Drawings.

B. Fabric duct shall be standard round shape with high-throw air distribution system with internal flow control devices to ensure proper distribution for this application.

C. Provide metal to fabric adapter, and fabric elbows, tees and offsets to form the duct layout shown.

D. Fabric shall be air permeable, Sedona-Xm FR polyester twill with anti-microbial treatment.

E. Standard color OR Premium color shall be selected by Architect. Customization such as lettering or logos shall be coordinated with Architect prior to ordering.

F. Provide cable suspension system with nylon snap clips.

G. Manufacturer shall provide CFD computer analysis of their proposed duct system showing even air distribution for the specific application on this project.

H. Acceptable Manufacturers: DuctSox, Durkeesox, KE-Fibertec, Prihoda

END OF SECTION

SECTION 23 41 00

PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 AIR FILTERS

A. GENERAL: Provide multiple sets of air filters for all supply air handling equipment for use during construction. During construction provide an additional pre-filter consisting of roll filter media installed across the air intake of the air handling equipment. Replace overlay filter media and filters during construction as necessary to protect coils. Install a set of new filters prior to Testing and Balancing of the system. Provide a final set of new filters at Substantial Completion for Owners use, including installation when necessary.

B. FILTER MEDIA: FILTER MEDIA: 2" thick, Farr Type 30-30 MERV 8 efficiency, pleated, disposable type filter. Where noted on the drawings provide similar MERV-13 filter (or what is noted).

C. VRF SYSTEM: For the VRF system, clean washable filters provided with the units periodically during construction. At the time of final acceptance, filters shall be freshly cleaned.

END OF SECTION

SECTION 23 51 00

BREECHINGS, CHIMNEYS AND STACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

PART 2 - MATERIALS AND METHODS

2.1 FLUE VENTS

A. GENERAL: Required for all gas fired equipment.

B. NON-CONDENSING, LARGE WATER HEATER AND BOILER FLUE PIPE: U. L. Listed, pressure rated, double pipe with, .025” thick AL29-4C stainless steel inner jacket, 304 stainless steel outer jacket and a minimum of one inch air gap between pipes to limit surface temperature to 160° F.

C. CONDENSING, LARGE WATER HEATER AND BOILER FLUE PIPE: Category IV vent system listed to UL 1738, pressure rated, double pipe with, .025” thick AL29-4C stainless steel inner jacket, 304 stainless steel outer jacket and a minimum of one inch air gap between pipes to limit surface temperature to 160° F.

D. FURNACE FLUE PIPE: Double pipe galvanized steel with .035” thick stainless steel inner liner and air space between inner and outer pipes. Metalbestos Model DF.

E. CAPS: Galvanized steel, Breidert (or similar Acme or Triangle) Type L on stack extension above flashing base. Bottom plate of cap shall be higher than any parapet wall within 10 feet and in no case less than four feet above the roof. Provide ventilated roof thimble at roof penetration.

F. CLEARANCES: Maintain adequate clearance from combustible materials to prevent fire hazard. Provide thimble for pipe passing through combustible materials.

G. SLEEVES: Provide airtight sleeves around all vents passing through ceiling cavity or plenum spaces to prevent flue gases from escaping into cavity space.

H. ACCESSORIES Provide support brackets and collars, rain entrainment section with 1” drain, rain collars and other accessories for a complete system installation. Equipment that recommends installation of a barometric damper, provide damper installed in a “T” section near the equipment flue connection.

I. VENT KIT: Provide installation kit, vent cap, and accessories for horizontal venting of boiler flue gas. Kit and accessories shall be designed to serve a Category IV vent system. Construction shall be 304 stainless steel. Accessories shall include wall thimble, termination hood/cap.

J. ACCEPTABLE MANUFACTURERS: Heat Fab, Metalbestos, Metal Fab and Pro-Tech Systems

END OF SECTION

SECTION 23 52 16

CONDENSING HEATING BOILER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements included in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 QUALITY ASSURANCE

A. Construct the boiler shell in accordance with the ASME Code for 160 PSI working pressure. The boilers shall be inspected by an authorized inspector during construction.

B. Boiler shall be hydrostatically tested and registered with the "National Board of Boiler and Pressure Vessel Inspectors".

C. Furnish 6 copies of the "Manufacturers' Data Report" for the boiler.

D. Boiler shall be approved as a unit by the CSA and bear the CSA label.

E. The burner, gas train and controls shall conform to the requirements of I.R.I./GE Gap

F. The boiler and installation shall conform to the Boiler Law Rules and Regulations of the Boiler Division of the Texas Department of Labor and Standards.

G. Provide factory tests to check construction, controls and operation of unit.
   1. Each boiler shall be completely assembled, wired, fire tested and preset to fire at its rating before leaving the factory.
   2. Provide a certificate of the factory fire test.

1.3 ACCEPTABLE MANUFACTURERS

A. Raypak X-Vers / X-Fire Boiler

B. Hydrotherm KN

C. Lochinvar Crest

1.4 SHOP DRAWING SUBMITTALS

A. Submit data sufficient to show compliance with Contract Documents.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. 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.

B. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.

C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."

D. ANSI Compliance: Boilers shall be compliant with ANSI Z21.13 test standards for US and Canada.

1.7 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.8 WARRANTY

A. Standard Warranty: Boilers shall include manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Fire-Tube Condensing Boilers:
      a. Heat Exchanger, Pressure Vessel and Condensation Collection Basin shall carry a 10 year limited warranty against defects in materials or workmanship and 25 years for a failure due to thermal shock.
      b. All other components shall carry a one year warranty from date of boiler start up.

1.9 OPERATIONS PERSONNEL TRAINING

A. Provide a training session for the owner’s operations personnel. Training session shall be performed by a qualified person who is knowledgeable in the subject system/equipment. Submit a training agenda two (2) weeks prior to the proposed training session for review and approval. Training session shall include at the minimum:
   1. Purpose of equipment.
   2. Principle of how the equipment works.
   3. Important parts and assemblies.
   4. How the equipment achieves its purpose and necessary operating conditions.
   5. Most likely failure modes, causes and corrections.
   6. On site demonstration.
   7. Programming of built-in controllers.
   8. Complete tear-down of boiler for repairs, servicing or cleaning.

PART 2 - MATERIALS AND METHODS

2.1 CONSTRUCTION

A. Description: Boiler shall be natural gas fired, fully condensing, and fire tube, water tube, or cast iron design. The boiler shall be factory-fabricated, factory-assembled, and factory-tested, condensing boiler with heat exchanger sealed pressure tight, built on a steel base; including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls.

B. Heat Exchanger: The heater exchanger shall bear the ASME “H” stamp for 160 psi working pressure and shall be National Board listed. The heat exchanger shall be designed for a single-pass water flow to limit the water side pressure drop. There shall be no banding material, bolts, gaskets or “O” rings in the heat exchanger design.

C. Condensate Collection Basin: Fully welded 316L stainless steel.

D. Boiler shall include an intake air filter with a factory installed air pressure switch. The pressure switch will alert the end user on the screen of the boiler that the intake filter is dirty and needs to be changed.

E. The pressure vessel shall be in accordance with ASME Section IV pressure vessel code.

F. Burner shall be a forced draft single burner premix design with an upper and lower chamber supplied by individual combustion systems. The burner shall be capable of the stated gas train turndown of 10:1 without loss of combustion efficiency. The burner shall have an independent laboratory rating for Oxides of Nitrogen (NOx) to meet requirements of the T.C.E.Q.

G. Blower: Boiler shall be equipped with a pulse width modulating blower system to precisely control the fuel/air mixture to provide modulating boiler firing rates for maximum efficiency. The burner firing sequence of operation shall include pre-purge, firing, modulation, and post-purge operation.
   1. Motors: Comply with requirements specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."

H. Gas Train: The boiler shall be supplied a gas valve designed with negative pressure regulation.

I. Ignition: “Rich Start” hot surface ignition with 100 percent main-valve shutoff with electronic flame supervision.

J. Casing:
   1. Jacket: Heavy gauge primed and painted steel jacket with thumb screw enclosures.
   2. Control Compartment Enclosures: NEMA 250, Type 1A.
   3. Insulation: Minimum ½ inch thick, mineral fiber insulation surrounding the heat exchanger.
   4. Combustion-Air Connections: Inlet and vent duct collars.

2.2 TRIM

A. Safety Relief Valve:
   1. Size and Capacity: 75 lb.
   2. Description: Fully enclosed steel spring with adjustable pressure range and positive shutoff; factory set and sealed.

B. Pressure Gage: Minimum 3-1/2 inch diameter. Gage shall have normal operating pressure about 50 percent of full range.

C. Drain Valves: Minimum NPS 3/4 or nozzle size with hose-end connection.

D. Condensate Neutralization Kit: Factory supplied condensate trap with condensate trip sensor, high capacity condensate receiver prefilled with appropriate medium.

2.3 CONTROLS

A. Boiler controls shall feature a standard, factory installed 7” LCD screen display with the following standard features:
   1. Two pump control: Boiler shall have the ability to control the boiler pump, and system pump.
   2. Anti-cycling control: Boiler shall have the ability to set a time delay after a heating demand is satisfied allowing the boiler to block a new call for heat. The boiler will display an anti-cycling blocking on the screen until the time has elapsed or the water temperature drops below the anti-cycling differential parameter. The anti-cycling control parameter is adjustable by the installer.
   3. Night setback: Boiler may be programmed to reduce the space heating temperature set point during a certain time of the day.
   4. Freeze protection: Boiler shall turn on the boiler and system pumps when the boiler water temperature falls below 45 degrees. When the boiler water temperature falls below 37 degrees the boiler will

automatically turn on. Boiler and pumps will turn off when the boiler water temperature rises above 43 degrees.
5. Isolation valve control: Boiler shall have the ability to control a 2-way motorized control valve. Boiler shall also be able to force a fixed number of valves to always be energized regardless of the number of boilers that are firing.
6. BMS integration with 0-10V DC input: The Control shall allow an option to Enable and control set point temperature or control firing rate by sending the boiler a 0-10V input signal.
7. Data logging: Boiler shall have non-volatile data logging memory including last 10 lockouts, hours running and ignition attempts and should be able to view on boiler screen.

B. The boiler shall have a built in Cascade controller to sequence boilers. The factory installed, internal cascade controller shall include:
1. Efficiency optimization: The Control module shall allow multiple boilers to fire at minimum firing rate in lieu of Lead/Lag.
2. Front end loading

C. Boiler operating controls shall include the following devices and features:
1. Set-Point Adjust: Set points shall be adjustable.
2. Operating Pressure Control: Factory wired and mounted to cycle burner.
3. Sequence of Operation: Factory installed controller to modulate burner firing rate to maintain system water temperature in response to call for heat.
4. Sequence of Operation: Electric, factory-fabricated and factory-installed panel to control burner firing rate to reset supply-water temperature inversely with outside-air temperature. At 10 deg F outside-air temperature, set supply-water temperature at 180 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 140 deg F.

D. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
1. High Temperature Limit: Automatic and manual reset stops burner if operating conditions rise above maximum boiler design temperature. Limit switch to be manually reset on the control interface.
2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manually reset on the control interface.
3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
4. High and Low Gas Pressure Switches: Pressure switches shall prevent burner operation on low or high gas pressure. Pressure switches to be manually reset on the control interface.
5. Proof of Closure Valve: Proof of closure valve (POC) shall prevent the boiler from firing if the POC valve seat is detected open. Upon a call for heat, once the POC valve seat is proven to be closed, the pre-purge cycle will begin and the POC valve will begin to open.
6. Blocked Drain Switch: Blocked drain switch shall prevent burner operation when tripped. Switch to be manually reset on the control interface.
7. Low air pressure switch: Pressure switches shall prevent burner operation on low air pressure. Switch to be manually reset on the control interface.

E. Building Automation System Interface: Factory installed Modbus gateway interface to enable building automation system to monitor, control, and display boiler status and alarms.

2.4 ELECTRICAL POWER

A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in Division 26 Sections.

B. Single-Point Field Power Connection: Factory-installed and factory-wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.

C. Electrical Characteristics:
1. See Drawings
2. Voltage as specified on equipment schedule.

2.5 VENTING

A. Exhaust flue must be Category IV approved stainless steel sealed vent material from one of the approved manufacturers listed in the Installation and Operation manual. Boilers exhaust vent length must be able to extend to 100 equivalent feet.

B. Boiler venting and intake piping configuration shall be installed per one of the approved venting methods shown in the Installation and Operation manual.

C. Boiler shall come standard with a flue sensor to monitor and display flue gas temperature on factory provided LCD display.

D. Boilers using common venting must contact the factory for sizing.

E. Refer to manufacturer's Installation and Operations manual for detailed venting instructions and approved manufacturers.

2.6 SOURCE QUALITY CONTROL

A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.

B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.

C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install where shown on the Drawings. Follow manufacturer's instructions.

B. Install equipment in strict compliance with manufacturer's installation instructions.

C. Install equipment in strict compliance with state and local codes and applicable NFPA standards.

D. Maintain manufacturer's recommended clearances around sides and over top of equipment.

E. Provide all electrical control and power interconnect wiring.

F. Provide all fuel gas vent and service piping. Boiler(s) will require Category IV vent material. Boiler requires an exit cone vent termination or a rain cap (depending on manufacturer's requirements).

G. Provide all piping for boiler pipe connections.

3.2 OPERATION TESTS

A. Controls: At the time the boiler is ready to be placed in operation, make a check of the proper operation of all controls, including safety controls and relief valve.

H. Efficiency: Run a flue gas analysis to determine the following at both high and low fire.
1. Establish minimum specified efficiency
2. CO_2, O_2, CO, NO_x (corrected at 3% O_2), Stack Temperature
3. Stack pressures

I. Boiler manufacturer and mechanical contractor to coordinate with BAS contractor that the boiler system is functioning as designed.

3.3 FACTORY START UP:

A. Shall be performed by manufacturer or the manufacturer's representative.

B. Test during operation and adjust if necessary

C. Safeties

D. Operating Controls

E. Static and full load gas supply pressure

F. Gas manifold and blower air pressure

G. Amp draw of blower

H. Submit copy of start-up report to Mechanical Engineer.

END OF SECTION

SECTION 23 64 00

WATER CHILLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 TRAINING

A. Chiller manufacturer shall provide two days of training for two Owner representatives at the Owner's facility.

B. This training will be hands-on and classroom type training which will pertain to the purchased equipment. The training shall be a combination of classroom and hands-on training that will give the trainees the ability to completely tear down and overhaul the purchased equipment.

PART 2 - MATERIALS AND METHODS

2.1 AIR COOLED SCROLL CHILLER

A. GENERAL: Unit shall be an ARI certified packaged air cooled chiller with two or more scroll compressors suitable for outdoor installation. Unit shall have two completely independent refrigeration circuits utilizing R-32 refrigerant. Provide accessories for a complete system including starters, disconnecting circuit breakers, control voltage transformer, controls system and electronic expansion valve. All cold surfaces shall be insulated to prevent condensation. Unit shall be fully charged with refrigerant and oil. Provide security wire guards around the compressor area.

B. COMPRESSOR: The compressors shall be sealed hermetic, scroll type with crankcase oil heater and suction strainer. The compressor motor shall be refrigerant gas cooled, high torque, hermetic induction type, two-pole, with inherent thermal protection on all three phases and shall be mounted on RIS vibration isolator pads. The compressors shall be equipped with an internal module providing compressor protection and communication capability. Motor shall have a power factor of 0.9 or greater and have internal electronic overheating protection. Compressor shall have sound reduction enclosures and sound deadening wraps on discharge piping.

C. EVAPORATOR:
1. The evaporator shall be a compact, high efficiency, dual circuit, brazed plate-to-plate type heat exchanger consisting of parallel stainless steel plates.
2. The evaporator shall be protected with an external, electric resistance heater plate. The evaporator shall be insulated with 3/4" (19 mm) thick CFC and HCFC-free closed-cell flexible elastomeric foam insulation material with 100% adhesive coverage. The insulation shall have an additional outer protective layer of 3mm thick PE embossed film to provide superior damage resistance. Insulation without the protective outer film shall not be acceptable. UV resistance level shall meet or exceed a rating of 'Good' in accordance with the UNI ISO 4892 - 2/94 testing method. This combination of a

heater plate and insulation shall provide freeze protection down to -20°F (-29°C) ambient air temperature.

3. The water-side working pressure shall be a minimum of 435 psig (3000 kPa). Vent and drain connections shall be provided in the inlet and outlet chilled water piping by the installing contractor. Evaporators shall be designed and constructed according to, and listed by, Underwriters Laboratories (UL).

D. CONDENSER:
1. Condenser fans shall be propeller type arranged for vertical air discharge and individually driven by direct-drive fan motors. The fans shall be equipped with a heavy-gauge vinyl-coated fan guard. Fan motors shall be TEAO type with permanently lubricated ball bearings, inherent overload protection, three-phase, direct-drive, 1140 rpm. Each fan section shall be partitioned to avoid cross circulation.
2. Coil shall be microchannel design and shall have a series of flat tubes containing multiple, parallel flow microchannels 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. Coils shall consist of a two-pass arrangement. Each condenser coil shall be factory leak tested with high-pressure air under water.
3. Condenser coils shall include baked epoxy coating providing 10,000+ hour salt spray resistance (ASTM B117- 90).

E. CONSTRUCTION
1. Unit formed sheet metal components shall be painted using a corrosion resistant paint system, for aesthetics and long-term durability. Paint system will include a base primer with a high-quality polyester resin topcoat. Painted galvanized parts shall be G60 or greater and finished, unabraded panel surfaces shall be capable to be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16” at 1,000 hours minimum exposure to an ASTM B117 salt spray environment.
2. Options
   a. Painted steel wraps enclosing the coil end sections and piping
   b. Protective, 12 GA, PVC-coated, wire coil guards for the vertical upper coil section of the unit
   c. Protective, 12 GA, PVC-coated, wire base guards for the lower section of the unit

F. CONTROL CABINET AND ELECTRICAL INTERCONNECT
1. A centrally located weatherproof control panel shall contain the field power connection points, control interlock terminals, and control system. Box shall be designed in accordance with NEMA 3R rating. Power and starting components shall include factory circuit breaker for fan motors and control circuit, individual contactors for each fan motor, solid-state compressor three-phase motor overload protection, inherent fan motor overload protection and single-point connection to a non-fused disconnect switch with through-the-door handle and compressor circuit breakers. Hinged access doors shall be lockable. Barrier panels or separate enclosures are required to protect against accidental contact with line voltage when accessing the control system.
2. Shall include high short circuit current rating of 65,000 amps (25,000 amps at 575 Volt) with single-point disconnect switch.
3. Provide a powered 120V, ground fault, duplex convenience outlet.

G. CONTROLS: An advanced DDC microprocessor unit controller with a 5-line by 22-character liquid crystal display provides the operating and protection functions. The controller shall take preemptive limiting action in case of high discharge pressure or low evaporator pressure. The controller shall contain the following features as a minimum:
1. Equipment Protection
   a. The unit shall be protected in two ways:
      1) by alarms that shut the unit down and require manual reset to restore unit operation and
      2) by limit alarms that reduce unit operation in response to some out-of-limit condition. Shutdown alarms shall activate an alarm signal.
   b. Shutdown Alarms:
      1) No evaporator water flow
      2) Sensor failures
      3) Low evaporator pressure
      4) Evaporator freeze protection
      5) High condenser pressure

6) Outside ambient temperature (auto-restart)
7) Motor protection system
8) Phase voltage protection

c. Limit Alarms
1) Condenser pressure stage down, unloads unit at high discharge pressures
2) Low ambient lockout, shuts off unit at low ambient temperatures
3) Low evaporator pressure hold, holds stage #1 until pressure rises
4) Low evaporator pressure unload, shuts off one compressor

d. Unit Enable Selection
1) Enables unit operation from either local keypad, digital input, or BAS

e. Unit Mode Selection
1) Selects standard cooling, ice, glycol, or test operation mode

f. Analog Inputs
1) Reset of leaving water temperature, 4-20 Ma
2) Current Limit

g. Digital Inputs
1) Unit off switch
2) Remote start/stop
3) Flow switch
4) Motor protection

h. Digital Outputs
1) Shutdown alarm; field wired, activates on an alarm condition, off when alarm is cleared
2) Evaporator pump; field wired, starts pump when unit is set to start

i. Condenser Fan Control
1) The unit controller shall provide control of condenser fans based on compressor discharge pressure.

j. Building Automation System (BAS) Interface
1) Factory mounted DDC controller(s) shall support operation on a BACnet®, Modbus® or LonMark® network via one of the data link / physical layers listed below as specified by the successful Building Automation System (BAS) supplier.
i. BACnet® MS/TP master (Clause 9)
ii. BACnet® IP, (Annex J)
iii. BACnet® ISO 8802-3, (Ethernet)
iv. LonMark® FTT-10A. The unit controller shall be LonMark® certified.
v. The information communicated between the BAS and the factory mounted unit controllers shall include the reading and writing of data to allow unit monitoring, control and alarm notification as specified in the unit sequence of operation and the unit points list.
vi. For chillers communicating over a LonMark® network, the corresponding LonMark® External Interface File (XIF) shall be provided with the chiller submittal data.
vii. All communication from the chiller unit controller as specified in the points list shall be via standard BACnet® objects. Proprietary BACnet® objects shall not be allowed. BACnet® communications shall conform to the BACnet® protocol (ANSI/ ASHRAE135-2001). A BACnet® Protocol Implementation Conformance Statement (PICS) shall be provided along with the unit submittal.

H. OPTIONS:
1. Provide factory supplied rubber in sheer vibration isolators matched to the specific chiller supplied. Provide a minimum of four isolators per side evenly distributed around the perimeter of the unit.
2. Hot Gas Bypass: Allows unit operation to 10% of full load. Includes factory-mounted hot gas bypass valve, solenoid valve, and manual shutoff valve for each circuit. Shall be ready for field piping according to manufacturer instructions.
3. Low Ambient Control: Fan VFD allows unit operation down to -10°F (-23°C).
4. Ground Fault Protection: Factory installed circuit breaker to protect equipment from damage from line to-ground fault currents less than those required for conductor protection.
5. Phase loss with under/over voltage protection and with LED indication of the fault type to guard against compressor motor burnout.
6. Compressor sound reduction package
7. 115V GFI convenience outlet
8. BAS interface module, factory mounted

I. FACTORY-INSTALLED PUMP PACKAGE (WHERE SCHEDULED, REF. DRAWINGS)

1. The pump package shall be factory mounted and wired on the chiller. The chiller controller shall provide a pump start/stop signal when operation is required. The package shall be equipped with:
   a. Single Pump Model 4380: single spring inside seal, vertical, in-line, radially split-case pump, serviceable without breaking pipe connections. The motor and pump rotating assembly shall be serviceable without removing the pump casing from the
   b. Pump package shall also be equipped with:
      1) "Y" type inlet strainer
      2) Combination triple-duty outlet valve having a drip-tight discharge shutoff valve, non-slam check valve, and flow throttling valve
      3) Combination suction guide with flow stabilizing outlet vanes and stainless steel strainer with a disposable fine-mesh strainer for start-up
      4) Factory power and control wiring from the chiller to the pump package control panel
      5) Flow switch mounted and wired
      6) Interconnecting schedule 40 piping with grooved couplings
      7) Insulation of all cold surfaces
      8) Water pressure gauges on the pump suction and discharge
      9) Storage tanks, vertical, insulated 300 gallon with optional immersion heater, field installed.
   c. INTEGRAL PUMP POWER WIRING: Integral pump shall be on separate power connection from chiller and shall be wired to be on emergency generator power. Manufacturer and contractor shall field coordinate the installation of this arrangement.

J. SOUND RATINGS: Emitted sound pressure shall note exceed 67 dBA as measured from the ends of the unit and 70 dBA at 30 feet from the sides of the unit.

K. INSPECTION AND TEST: Upon completion of installation, an authorized representative of the manufacturer of the chilling unit shall inspect the installation and certify that the unit ready for operation. He shall supervise the starting and observe the operation and performance of the equipment.

L. WARRANTY: Provide a one year warranty (parts and labor) for total unit. Provide a four year extended warranty (second through fifth year) on the motor-compressor-drive assembly for parts and labor, including refrigerant. All replacement parts shall be newly manufactured. For each chiller provide factory certificates listing chiller model, serial number and warranty information in the close out documents.

M. ACCEPTABLE MANUFACTURERS: Carrier, Daikin, Trane and York

2.2 SHORT CIRCUIT RATING – APPLICABLE TO CHILLERS OF ALL TYPES:

A. Each chiller, as a complete unit, shall be given a single integrated equipment rating by the manufacturer. The integrated equipment short-circuit rating shall certify that all equipment is capable of withstanding the stresses of a fault equal to that of the least overcurrent protective device contained therein. Such rating shall be established by actual tests by the manufacturer on similar equipment construction as the subject chiller. Chiller distribution sections shall be braced for a minimum of 65,000 amps symmetrical at 480V. Reference drawings for additional information.

END OF SECTION

SECTION 23 73 13

INDOOR CENTRAL STATION AIR HANDLING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 SUBMITTALS

A. Provide submittals as outlined in Section 23 00 00 General HVAC

PART 2 - MATERIALS AND METHODS

2.1 INDOOR AIR HANDLING UNITS

A. CABINET CONSTRUCTION:
1. Fabricate unit with 16 gauge channel posts and panels secured with mechanical fasteners. All panels, access doors, and ship sections shall be sealed with permanently applied bulb-type gasket. Shipped loose gasketing is not allowed.
   a. Panels and access doors shall be constructed as a 2-inch (50-mm) nominal thick; thermal broke double wall assembly, injected with foam insulation for an R-value of not less than R-13. The outer panel shall be constructed of G90 galvanized [18-gauge] steel. The inner liner shall be constructed of G90 galvanized steel.
   b. Panel deflection shall not exceed L/240 ratio at 125% of design static pressure, maximum positive or negative 8 inches of static pressure. Deflection shall be measured at the midpoint of the panel height.
   c. Panel assembly shall meet UL standard 1995 for fire safety. Panel assembly shall comply with the material requirements of NFPA 90A.
   d. The casing leakage rate shall not exceed [0.50 cfm per square foot of casing surface area at design static pressure up to a maximum of +5” w.c. in positive pressure sections and -6” w.c. in negative pressure sections (.0025 m3/s per square meter of cabinet area at 1.24 kPa static pressure) for standard cabinet units.] [ASHRAE 111 Class 6 at design static pressure up to a maximum of +8” w.c. in positive pressure sections and -8” w.c. (1.99 kPa) in negative pressure sections, where casing leakage (cfm/100 ft2 of casing surface are) = CL × P0.65 for high pressure cabinet units] [1% of supply air volume at design static pressure up to a maximum of +8” w.c. in positive pressure sections and -8” w.c. (1.99 kPa) in negative pressure sections for high pressure cabinet units].
   e. The condensate drain pans shall be insulated, double wall type of 16-gauge Type 304 stainless steel, sloped for positive drainage and extend a minimum of 12” beyond the coil. Provide drain pan for all coils, including heating coils.
   f. Provide minimum 12-gauge rails or channels on bottom of unit to ensure bottom plates do not contact floor or concrete pad. Coordinate drain location with mechanical room layout.

B. ARRANGEMENT AND COMPONENTS: Units shall be horizontal or vertical as shown on the Drawings. Unless noted otherwise, heating coils shall be in the reheat position.

C. FAN SECTION
   1. PLENUM FANS:
      a. Fan shall be single width single inlet backward inclined centrifugal airfoil fans.
      b. Impeller shall utilize non-overloading airfoil blades.
      c. Fan housing shall be bolted and welded using corrosion resistant fasteners.
      d. Inlet panel shall be constructed from heavy gauge, reinforced steel.
      e. Fan shall have a solid steel fan shaft mounted on grease lubricated ball bearings having a 200,000-hour average life. The fan/drive/motor assembly shall be internally mounted, and factory isolated from the enclosing cabinet with 2” minimum deflection spring isolators and flexible connection to unit housing.

D. ACCESS DOORS: Provide hinged, double wall, insulated and gasketed access doors with Ventlock 260 or equal handles on both inside and outside of casing. Provide 18” wide access door inside of unit at drain pan connection to observe and clean drain pan. Provide access doors on the upstream side of the coils, filters, and motor/fan assembly.

E. WATER COILS: Coils shall be 5/8”, .020” thick wall copper tube, .008” thick aluminum fin with belled collars, tested at 300 PSI with ARI certified ratings. Coils in outside air pre-treatment section or exposed to unconditioned ambient air shall have a flexible polymer e-coating (ElectroFin). Coil connections shall be counterflow with supply at the very bottom and outlet at the very top of the coil. Coils shall be drainable, non-trapping circuits. Coil casings shall be stainless steel. Headers shall have drain and vent connections extended to the outside of the unit casing. Mount coils on tracks for easy removal without requiring disassembly of the air handling unit. Install rubber grommets at all pipe penetrations of the cabinet. Coil assembly shall be minimum 6 rows with maximum 12 fins per inch. Fin type shall be waffle, corrugated, or sine. Flat fins are not acceptable.

F. FILTERS: Provide filter rack for 2" thick filters, maximum velocity 350 FPM. See specification section for Air Filters.

G. NAMEPLATE: Provide a factory installed aluminum nameplate, permanently mounted with the following information: Unit ID as indicated on the contract drawings, Model Number, Serial Number, Sales Order Number and Date of Manufacture.

H. SUBMITTAL: Provide a 1/4" scale drawing of each AHU room showing proposed unit placement with dashed-in access space required. Clearly indicate drive location, coil piping connections, and condensate drain connection. Provide side elevation drawing indicating fan placement, rotation, and discharge air opening, showing proper coordination of arrangement with the specified ductwork. Submittal shall include fan curve with efficiency and horsepower curves, and noise generated by octave. For VAV units, submit fan curves for operation at 50% and 100% of full output, while maintaining constant static pressure. All submittals shall be prepared by the Salesman that calls on the Engineer from the successful manufacturer.

I. BASIS OF DESIGN: Daikin Vision

J. ACCEPTABLE MANUFACTURERS: Carrier, Trane, and York/JCI

END OF SECTION

SECTION 23 81 00

DECENTRALIZED UNITARY HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 EQUIPMENT NAMEPLATES

A. Each piece of equipment shall have a stainless-steel nameplate with engraved or stamped 1/32" deep markings identifying manufacturer, model number, serial number, voltage, phase, amperage, refrigerant type, etc. as applicable. Attach to equipment with a minimum of two stainless steel fasteners.

PART 2 - MATERIALS AND METHODS

2.1 DUCT FREE SPLIT SYSTEM

A. GENERAL: System shall consist of outdoor condensing unit connected to one or more duct free, wall or ceiling mounted fan coil units. System shall be designed to operate as a unit complete with microprocessor control system.

B. AIR COOLED CONDENSING UNIT
1. HOUSING: Cabinet shall be constructed of galvanized steel, bonderized and coated with baked-enamel finish. Provide access panels for ease of service.
2. COMPRESSOR: Fully hermetic reciprocating or scroll type operating with R-410A or Puron refrigerant. Unit shall have internal protection for over temperature and over current. Provide crankcase heater. Refrigeration system shall have gage ports, service valves, accumulator, filter dryer and pressure relief. Heat pump units shall have reversing valve and heating mode metering device.
3. CONDENSER FAN: Direct drive propeller type with internally protected, totally enclosed motor.
4. CONTROLS AND SAFETIES: Unit shall have time delay restart, automatic restart on power failure, safety lockout, high and low pressure safeties.

C. EVAPORATOR UNIT
1. GENERAL: Indoor, ceiling or wall mounted, direct expansion fan coil unit complete with electric controls, microprocessor control system and integral temperature sensing.
2. WALL UNIT FAN UNIT: Direct drive tangential blower with automatic motor-driven vertical air sweep. Fan motor shall be three speed.
3. CEILING UNIT FAN UNIT: EC motor driven fan with radial discharge louvers and center return. Provide automated air flow options to control air flow direction and fan speed.
4. COIL: Copper tube aluminum fin with refrigerant metering device. Provide condensate drain pan and drip pan under headers. Provide float switch for drain line. Drain lines shall be gravity fed. Insulated refrigerant and condensate drain piping shall connect to the back of the unit so piping is concealed.
5. CONTROLS: Shall be microprocessor-based and control space temperature, determine optimum fan speed and run self-diagnostics. Provide remote wireless controller for programming and temperature

adjustment. Unit shall also be controllable directly from the building energy management system with varying schedule and temperature set points.

6. FILTERS: Provide factory supplied, permanent cleanable type filters with rack.

D. REFRIGERANT LINES: Provide factory supplied refrigerant lines connected to the back of the evaporator unit so lines are concealed.

E. ACCEPTABLE MANUFACTURERS:
1. Preferred: Mitsubishi.
2. Or equal by: York/JCI, Trane, Lennox, Carrier

PART 3 - EXECUTION

3.1 EQUIPMENT START-UP AND TESTING

A. Upon completion of unit installation, the contractor shall cover all unit inlets/outlets to prevent dust accumulation inside the unit.

B. Unit start-up shall not occur until after interior finished have been completed. The contractor shall not use the installed equipment to “dry out” the building, or provide comfort cooling during construction. If additional cooling is required for construction use, a separate, temporary HVAC system must be provided by or in coordination with the General Contractor.

C. Start-up shall include testing of all the unit operational states, along with associated unit performance. A factory start-up checklist shall be used and provided to the AE team for review. Start-up testing shall include:
1. Verification of cooling sequence
2. Verification of heating sequence
3. Verify refrigerant charge and pressures in both heating and cooling.
4. Verify control of fan speed from wall controller.
5. Verify unit CFM is within the range of factory specified CFMs.

D. Filter Maintenance:
1. Units with washable return air filters shall have filters cleaned prior to start-up and cleaned again prior to turning building over to the owner.
2. Units with replaceable filters shall have new filters installed prior to start-up and again prior to turning building over to the owner.

END OF SECTION

SECTION 25 00 00

GENERAL CONTROLS REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

1.2 RELATED WORK

A. Section 25 00 00 – General Controls Requirements

B. Section 25 00 10 – BAS Closeout Requirements

C. Section 25 50 20 – DDC System for HVAC Controls

D. Section 25 95 10 – Sequence of Operations for HVAC Controls

E. Section 26 09 43 – Network Lighting Controls

F. Section 26 32 13 – Packaged Generator Assemblies

G. Section 26 36 23 – Automatic Transfer Switch

H. Section 28 13 00 – Security and Access Control System

I. Section 28 31 00 – Fire Detection and Alarm

J. **Section 25 36 13 - Integrated Automation Power Meters (ADD #2, 01.15.2024)**

1.3 INTENT OF DRAWINGS AND SPECIFICATIONS

A. GENERAL: Drawings and Specifications are intended to be complimentary. Any work described in either of the documents will be required under this contract. Conflicts or discrepancies between the Drawings and the Specifications shall be clarified by RFI. Barring clarification prior to bidding the most expensive option shall be included and clarification shall be made during construction. Should any work required by the drawings and specifications be in violation of any Federal, State, County or City laws, ordinance or regulation, those laws and regulations shall prevail, and shall be complied with by the Contractor as a part of this work with no extra compensation.

B. DRAWINGS: The drawings are schematic in nature, intended to show the various components of the system approximately to scale and indicate how they are to be integrated with other parts of the building. Determine exact locations by close coordination with the Owner's Representative, job measurements, determining the requirements of other trades and reviewing all contract documents. The Drawings indicated general routing of the various parts of the systems, but do not indicated all fittings and offsets which may be required to fit the system into spaces allotted for them. The Contract shall include these items as required for a complete installation.

C. BASIS OF DESIGN: Equipment that is scheduled is the basis of the design and has been coordinated for space, installation and electrical requirements. Equipment and models from other

acceptable manufacturers have not been verified or coordinated. Contractor shall verify these requirements prior to using other equipment in his bid and include any additional costs for installation of the substitute equipment.

1.4 MATERIALS

A. GENERAL: Manufacturer's printed directions shall be followed for preparing, assembling, installing, erecting and cleaning manufactured materials or equipment, unless otherwise directed. Materials, when not otherwise definitely specified, shall conform to applicable National Specifications and Standards. All materials shall be certified to not contain any asbestos or other material banned by the Environmental Protection Agency. Lead shall not be used in any material, pipe or solder in contact with the domestic water system.

B. SUBSTITUTION: The names of manufacturers and model numbers have been used in the Contract Documents to establish type of equipment and standard of quality. Where only one name is mentioned for a particular item of material, then that manufacturer is the only one acceptable. Where several names are mentioned, any one of those listed may be furnished provided submittal contains sufficient information to show complete compliance with contract Documents. No attempt has been made to determine if each manufacturer listed will produce material that will comply with all requirements of this project or will fit the allotted space.

C. SUBSTITUTION REQUIREMENTS: Requests for substitution during the bidding period, in accordance with the requirements of the Special Conditions, must be accompanied by a complete product submittal with all features, accessories and capacities noted. Large equipment must include a drawing to scale showing how the equipment and required access space will fit the available space. Acceptance for bidding does not waive the post bidding requirement for formal submittal and approval.

1.5 RELATED WORK SPECIFIED IN OTHER SECTIONS

A. ELECTRICAL: Power wiring is specified in the Electrical Section. Interlock and control wiring (any voltage) is specified under this Section. Controllers and starters, unless part of a motor control center, are specified under this Section.

B. PAINTING OF EQUIPMENT, PIPING AND ACCESSORIES: Painting Section. However, all items furnished under this Section shall be kept clean and free from corrosion.

C. OPENINGS: Various other sections. The locations of all inserts and openings shall be determined under this Section and coordinated with the other Sections in ample time to avoid cutting new construction.

D. EQUIPMENT AND PIPING SUPPORT REQUIREMENTS: Refer to structural drawings, details and notes for specific support and pipe hanging requirements. Specific loading and attachment methods shall be followed to assure that individual structural members are not overloaded.

1.6 ALTERNATES

A. GENERAL: Determine the scope of each specified alternate proposal by carefully reading all Divisions of the Documents. The Bid Form contains information explaining the extent of the construction to be performed under a specific alternate. Alternate proposals, which are not predominantly mechanical in scope, are described in other Divisions of these Documents. Pay particular note to re-roofing items that may necessitate adjustments to existing piping.

1.7 PERMIT, FEES, AND APPROVALS

A. The contractor shall obtain and pay for all permits and fees to perform his work. He shall comply with all laws, ordinances, rules and regulations bearing on the conduct of the work specified or shown on the drawings. This applies to Federal, State and Local Codes and Requirements.

Approval from the various insuring and inspection authorities shall also be obtained. Refer to Architectural sections for additional information.

1.8 VISITING THE SITE

A. The Contractor shall be familiar with the Drawings and Specifications and shall have examined the premises and understand the conditions under which he will be obligated to operate in performing the contract. No additional compensation shall be allowed for failure to fully understand the requirements.

1.9 GUARANTEE

A. All materials, apparatus and equipment furnished and installed under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner unless noted to have extended warranties.

1.10 INSTALLATION REQUIREMENTS

A. COORDINATION: The Contractor shall cooperate with other trades on the job and make installations in the proper sequence during the construction of the building. They shall notify the Architect well in advance of construction of all interference of his work with that of other trades and of building construction. This notification shall not relieve the contractor of his responsibilities to coordinate his work with the total project.

B. WORKMANSHIP: All work shall be performed in a neat workmanlike manner and in the best practice of the trade. Only workmen skilled in the trades shall be employed to perform the work included in these specifications.

C. CLEAN-UP: Keep area of operations free from accumulation of waste material or rubbish at all times. All piping above accessible ceilings shall be cleaned of cement, plaster, and other construction debris prior to being concealed. The parts of the Mechanical installation which are to be painted or insulated shall be thoroughly cleaned of cement, plaster, grease, oil spots and other materials in preparation for painting or insulating.

D. EQUIPMENT PROTECTION: Do not deliver equipment to the jobsite until it is actually needed for installation. Protect equipment from damage due to construction activities and the weather. Equipment allowed to stand in weather will be rejected and Contractor is obligated to furnish new equipment at no cost to Owner.

E. CUTTING AND PATCHING: Coordinate the work with other trades to arrange for all holes, chases, and other spaces necessary for the installation of all components of the mechanical systems. Inform the other trades in ample time for these to be provided. Where concrete flooring or paving must be cut to install MEP systems, contractor shall take measures to prevent damaging existing underground services. Contractor shall x-ray the area to be sawed or cut to determine the existence of underground services. When saw cutting, limit the depth of the cut to less than the thickness of the concrete. Breakout the concrete manually with special care in areas of possible underground services.

F. STRUCTURAL STEEL: All structural steel used for the purpose of fabricating equipment supports, pipe supports, pipe guides, pipe anchors and framing for large ducts and plenums, shall conform to ASTM Designation A-36. All steel used for these purposes shall be new, clean, straight and galvanized.

1.11 OPERATION TESTS AND ADJUSTMENTS

A. After completion of the work and before final acceptance thereof, the Contractor shall notify the Architect when he is ready for the balancing of air and hydronic systems which will be performed by a professional test and balance firm selected by the Owner as described in Section 23 05 93.

1.12 SHOP DRAWINGS

A. All submittals shall be submitted in PDF form. Submittal will be reviewed with comments incorporated in this PDF. After final approval, Contractor shall provide a hard copy for use at the project site.

B. The purpose of these submittals is to attempt to aid the contractor in such a manner that improper or unacceptable materials are not delivered to or installed on the job. Shop drawings shall be approved before installation of the material under consideration. Approval of these submittals shall not be construed as releasing The Contractor from compliance with the Contract Documents. All materials and equipment shall be subject to final acceptance by the Engineer at completion of construction.

C. Shop Drawings shall consist of published ratings of capacity data, detailed construction drawings, wiring and control diagrams, performance curves, installation instructions, manufacturer's installation drawings and other pertinent data. Where the literature is submitted covering a group or series of similar items, the item under consideration shall be clearly indicated. Drawings shall be submitted showing revisions to equipment layouts due to use of alternate or substitute equipment. The front sheet of each copy of the submittal shall have the following typed information:

01 Job name and location.

02 General Contractor's name, address, project manager's name and telephone number.

03 Submitting Sub-contractor's name, address, project manager's name and telephone number.

04 Suppliers company name, address, salesman's name and telephone number.

D. Equipment that has regional representation shall only be supplied by the regional representative that serves the area where the project is located. The regional representative’s name and signature shall be included with the shop drawing.

E. Shop Drawings are required for but are not limited to the following items:

01 HVAC Controls Maps

02 Sequences of Operation

03 HVAC Controllers, Sensors, Devices and Accessories.

04 Control Valves, Dampers and Actuators

05 Wiring Diagrams

F. Approval of these submittals shall not be construed as releasing the contractor from compliance with the contract Documents. They are a means of coordinating the work and aiding in the proper selection and installation of equipment. Do not release items such as fire dampers and starters until associated equipment or ductwork drawings are approved. All materials and equipment shall be subject to final acceptance by the Engineer at the completion of construction and adjustments of the system.

G. If a submittal is returned to the Contractor marked “Rejected” or “Revise and Resubmit”, only one (1) additional submittal will be permitted without the Contractor incurring charges for the additional re-submittals. SEG shall be reimbursed by the Contractor for any expense in connection with any necessary submission in addition to the two (2) submissions allowed. Contractor will be billed by SEG at a rate of $125/hr for these occurrences.

1.13 SUBSTITUTIONS

A. The names of manufacturers and model numbers have been used in the Contract Documents to establish types of equipment and standards of quality and are intended to be the Basis of Bid. No attempt has been made to determine if each manufacturer listed for a particular item of equipment will produce material that will comply with all requirements. If only one manufacturer is named for a specific item of equipment (except lighting fixtures), the specified manufacturer will be the only acceptable one. Where more than one manufacturer is named for a specific item of equipment, only one of these manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer as outlined in Special Conditions and this Article. If a submittal contains sufficient information to prove compliance with the Contract Documents, then that submittal will be acceptable.

B. All other brands, including any additional names which may be listed as “Alternates” or “Approved Equal” must conform with the specifications, size, accessories, etc. of the first named brand and be subject to Paragraph D and E of this Article. Alternate equipment must be equal from the standpoint of materials, construction, and performance. Request for substitution must be accompanied by complete data and descriptive sheets during the bidding period as described in Paragraph D and E of this Article.

01 Submitted on Bidder’s letterhead attached to Proposal Form with individual deductive amounts stipulated and the documentation required in Paragraph E-03.

02 All savings for the Owner’s selection of deductive amounts by acceptance of alternate or substituted items are to be paid to the Owner.

C. All equipment within a common group or category shall be by the same manufacturer.

D. Proposed Substitutions/Approved Equals:

01 Submitted no less than 14 calendar days prior to bid date.

02 Submit proposed substitutions with catalog data and/or manufacturer’s shop details indicating all modifications required to conform with specified brand. Include all relevant items necessary to make a determination of equal status or submittal shall be deemed incomplete and rejected.

03 If submittal contains sufficient information to prove compliance with the Contract Documents, then that alternate submittal will be acceptable. Approved submittals solely for bidding purposes will be published by addenda.

E. Substitutions with prior approval:

01 Submitted on Bidder’s letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-2.

02 Owner reserves the right to accept or reject any or all substitution proposals before execution of Contract.

03 Provide all design/engineering services required to make adjustments 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.

1.14 BAS SYSTEM INSPECTIONS

A. GENERAL: Contractor shall formally request inspections of any and all BAS systems installations. Inspections shall include but not be limited to rough-in installations, wall cover inspections, above ceiling inspections and final inspection.

B. Contractor shall provide a MINIMUM of 48-hour notice prior to requested inspection time, no exceptions.

C. INSPECTION REPORTS: After each inspection, SEG will generate an inspection report and distribute it promptly. The Contractor will then be given 7 working days from date of report to address all deficiencies listed on the report. The GENERAL CONTRACTOR shall verify that all items on each inspection report have been addressed by their subcontractors in this time period. Once verified the GENERAL CONTRACTOR shall sign-off on each deficiency listed on the report and return the signed-off copy of the inspection report to SEG via e-mail. After the signed-off report is returned to SEG, the GENERAL CONTRACTOR shall request a re-inspection by SEG to close the report. If after 7 working days no re-inspection is requested by the GENERAL CONTRACTOR to close a report, SEG reserves the right to re-inspect whenever our schedule allows, with these re-inspections still being subject to Paragraph D below.

D. TEST REJECTIONS AND RE-INSPECTIONS: If a test is rejected or a re-inspection of an issued SEG Inspection Report is found to NOT be completely addressed, only ONE (1) additional inspection will be permitted without the Contractor incurring charges for each additional inspection required. SEG shall be reimbursed $500 by the GENERAL CONTRACTOR for expenses in connection with EACH inspection in addition to the two (2) inspections allowed.

1.15 COMMISSIONING AND TEST AND BALANCE

A. Third party commissioning and an independent test and balance contractor are a part of this project. Commissioning agent and T&B contractor will be under a separate contract directly with Owner. Refer to included specifications for commissioning and T&B.

B. The controls contractor shall work with the Mechanical Contractor to complete the pre-function checklist for the various mechanical devices. Checklists will be supplied by the commissioning agent.

C. The controls contractor shall work with the Mechanical Contractor to perform system tests as required by the commissioning agent in addition to any that are described in these specifications.

1.16 DEMOLITION AND REMODELING

A. In areas of demolition, the controls contractor shall remove all controls devices, cabinets, wiring or hangers not to be reused. Existing controllers shall be offered to the Owner for attic stock, and if accepted, delivered to their warehouse. If not accepted, it shall be properly disposed of with the other construction debris.

B. Where existing systems serve other areas as well, they shall remain active in those areas. Cap, patch and relocate ducts and piping to keep systems operable.

END OF SECTION 25 00 00

SECTION 25 00 10

BAS CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Plumbing Requirements as specified in Sections 23, apply to the work specified in this Section.

PART 2 - MATERIALS AND METHODS

2.1 CLOSEOUT REQUIREMENTS

A. ENERGY MANAGEMENT SYSTEM: No portion of the total contract will be declared substantially complete until the automatic temperature controls for that portion has been demonstrated to be complete and functioning as intended. The temperature control system shall maintain all of the space temperatures at plus or minus two degrees of set point.

B. AS-BUILT DRAWINGS: Obtain a set of project drawings and keep these at jobsite during construction. During the course of construction, mark on these prints any changes which are made, noting particularly locations for those items which will need to be located for servicing. At completion of job, mark each sheet "Record Drawings", date and deliver to Architect.

C. CLOSEOUT MANUALS: At completion of job, furnish three copies of spare parts lists and operating instructions for all equipment furnished under this Division. These lists and instructions shall be published by the manufacturer of the equipment. Bind in 3-ring binders with project name.

D. CLOSEOUT DOCUMENTS: Provide three printed copies of the approved submittal with wiring diagrams, sequences, floor plans and graphics updated to the final installation configuration.

2.2 GUARANTEES AND WARRANTIES

A. TEMPERATURE CONTROLS: The temperature control system and its proper operation shall be guaranteed for a period of one year after substantial completion and any control devices which prove to be defective during the guarantee period shall be repaired or replaced without cost to the Owner. After the initial warranty period, an additional twelve-month preventative maintenance contract shall be included in the base price of this Contract. This maintenance contract shall include quarterly preventive maintenance, all repair labor, parts and equipment. The system shall be warranted for parts and labor for a total of two years.

B. LIGHTING CONTROL DEVICES: Reference section 25 09 43 Integrated Automation Lighting Controls.

C. POWER METERING: Reference section 25 36 13 Integrated Automation Power Meters.

2.3 SPARE PARTS

A. GENERAL: Upon completion of the installation, deliver to the Owner all tools and spare parts that are furnished by the Equipment Manufacturer for use with the equipment furnished under this Contract.

2.4 TRAINING

A. TEMPERATURE CONTROLS SYSTEM: Provide 8 hours of instructions on system operation to Owner's personnel during the closeout period of the project. Additionally, the contractor shall supply the Owner with a training DVD that will instruct the Owner’s personnel on recommended, detailed, maintenance

procedures and troubleshooting of their equipment. Provide an additional 48 hours of instructions over a 3-year period for but not limited to operate interface program, software programming, system diagnostics, hardware installation and repair. No session to be more than 4 hours long with no limit on attendees. Technical support for 3 years over the phone shall be provided at no additional cost to the Owner. The Contractor shall be able to call and diagnose the system from his office.

END OF SECTION

SECTION 25 50 00

DIRECT DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General BAS Requirements as specified in Sections 25, apply to the work specified in this Section.

C. Equipment, line voltage cabling and low voltage cabling shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment, line voltage cabling and low voltage cabling shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 25 00 00.

1.2 RELATED WORK

A. Section 25 00 00 – General BAS Requirements

B. Section 25 00 10 – BAS Closeout Requirements

C. Section 25 36 13 – Integrated Automation Power Meters

D. Section 25 95 10 – Sequence of Operations for HVAC Controls

E. Section 26 00 00 – General Electrical Requirements

F. Section 26 05 00 – Common Work Results for Electrical

G. Section 26 09 43 – Network Lighting Controls

H. Section 26 24 00 – Switchboards and Panelboards

I. Section 26 29 00 – Low-Voltage Controllers

J. Section 26 32 13 – Packaged Generator Assemblies

K. Section 26 36 00 – Automatic Transfer Devices

L. Section 26 50 00 – Lighting

M. Section 26 56 68 – Exterior Athletic Field Lighting

N. Section 27 00 00 – General Technology Requirements

O. Section 27 10 00 – Communications Cabling General Requirements

P. Section 27 15 00 – Communications Horizontal Cabling

Q. Section 28 13 00 – Security and Access Control System

R. Section 28 31 00 – Fire Detection and Alarm

1.3 GENERAL REQUIREMENTS

A. DESCRIPTION: The Contractor shall modify and expand the existing campus Direct Digital Control (DDC) System with new devices local, as required, to monitor and control the HVAC systems in the new facilities. The final system shall provide unified access to all the buildings on the campus from one web based controls interface. The monitoring of certain electrical systems and equipment shall also be provided as noted in these specifications and associated control points listing.

B. MANUFACTURERS: The control system shall be manufactured by the following controls companies and be installed by their authorized local representative:
1. Delta Controls, installed by Team Solutions, LLC

C. EQUIPMENT: All DDC Temperature Control Equipment shall be the product of the approved controls manufacturer. All control valves shall be by Barber Colman, Belimo, Bray, Honeywell, Johnson, Robertshaw or Siemens. Controls contractor shall provide surge suppression (TVSS) protection for their equipment.

D. WIRING: System shall have a dedicated control network and not rely on the building network other than an interface to allow viewing of the control system. The Electrical Contractor shall provide a 20A, 120-volt power circuit to a single point in each mechanical room. The Controls Contractor shall extend this circuit as necessary to perform the controls functions as specified. Interlock wiring between fire alarm system's shut down relays and mechanical system starters, VFD's and temperature controls devices shall be provided by the Temperature Controls Contractor. All low voltage control and interlock wiring shall be provided by the Controls Contractor. All wiring shall be run in conduit except plenum rated, low voltage wiring above accessible ceilings may be installed without conduit if supported near structure separate from other low voltage systems. The installation of wiring and conduit shall be per the NEC and any special requirements of the electrical sections of these specifications.

E. SUBMITTALS: Provide equipment information, complete wiring diagram, floor plan drawings showing equipment locations (SEC's, power supplies, etc.), sequences of operations and drawings of graphics to be provided. Submittals shall be electronic in pdf format. Refer to submittal requirements in the General HVAC Requirements Section.

F. WARRANTY: The temperature control system and its proper operation shall be guaranteed for a period of one year after substantial completion and any control devices which prove to be defective during the guarantee period shall be repaired or replaced without cost to the Owner. After the initial warranty period, an additional twelve-month preventative maintenance contract shall be included in the base price of this Contract. This maintenance contract shall include quarterly preventive maintenance, all repair labor, parts and equipment. The system shall be warranted for parts and labor for a total of two years.

G. CLOSEOUT DOCUMENTS: Provide three printed copies of the approved submittal with wiring diagrams, sequences, floor plans and graphics updated to the final installation configuration.

H. TRAINING: Provide 8 hours of instructions on system operation to Owner's personnel during the closeout period of the project. Additionally, the contractor shall supply the Owner with a training DVD that will instruct the Owner's personnel on recommended, detailed, maintenance procedures and troubleshooting of their equipment. Provide an additional 48 hours of instructions over a 3-year period for but not limited to operate interface program, software programming, system diagnostics, hardware installation and repair. No session to be more than 4 hours long with no limit on attendees. Technical support for 3 years over the phone shall be provided at no additional cost to the Owner. The Contractor shall be able to call and diagnose the system from his office.

PART 2 - MATERIALS AND METHODS

2.1 INSTALLATION

A. GENERAL

1. The Stand Alone Control Units (SCU) and other controls processing units shall be located in air handling unit rooms and other mechanical rooms. Do not remote locate units in RTU's, above ceilings or non-mechanical room spaces.
2. The mechanical contractor shall receive, handle, mount and install all automatic temperature control valve bodies and linkages. All automatic control valves shall be furnished by the controls manufacture.
3. All control dampers shall be furnished by the control manufacturer and installed by the sheet metal contractor under the control manufacturer's supervision.

B. NAMETAGS: Install a plastic tape label identification tag on each item of control equipment, to correlate with the name shown on schematic drawing.

C. SENSOR LOCATIONS: Locations in finished spaces shall be reviewed with the Architect before beginning any installation work. Mount all wall sensors as noted on the floor plans at 46" above finished floor.

2.2 EQUIPMENT AND DEVICES

A. TEMPERATURE SENSORS
1. GENERAL: All sensors shall be thermistor type (10K at 77°F) with output over the scheduled temperature range.
2. ROOM SENSORS: Flush mounted within a wall box with aluminum cover. Sensing range shall be 45° to 96° F with an accuracy of ±.25° F. Mount at +46".
3. OUTDOOR AIR SENSORS: Waterproof with sunshield over sensing element. Sensing range shall be -30° to 130° F with an accuracy of ±1° F.
4. DUCT AIR SENSORS: Duct mounted junction box containing electronics and with minimum 9" long sensing probe. Sensing range shall be 32° to 134° F with an accuracy of ±1/2° F.
5. COIL SENSORS OR FREEZESTATS: Serpentine distributed sensor installed across the coil face.
6. WATER SENSORS: Immersion type, screwed into threaded, pipe weld-o-let. Chilled water and condenser water sensing range shall be 20° to 120° F with an accuracy of ±1/4° F. Heating water sensing range shall be 80° to 233° F with an accuracy of ±3/4° F.

B. VALVE AND DAMPER OPERATORS: Belimo, Delta, Siemens or one of the listed valve manufacturers.

C. DAMPERS: Shall be of the opposed blade type with the frame constructed of 16 gage galvanized sheet steel formed into channels, riveted and corner brackets added to maintain perfect alignment of the damper. In the closed position, all edges of blades must stop against other blades or a fixed stop, in a manner to provide tight shut-off. Provide synthetic elastomer seals on all edges of damper blades. Blades shall consist of two formed sheets spot welded together for extra strength. Square pins shall be used along with oil impregnated sintered bronze bearings. Leakage shall be less than 1/2% based on 2000 FPM approach velocity at 4" w.g. static. Submit certified test data for a typical damper, showing leakage characteristics.

D. TEMPERATURE CONTROL VALVES: Three-way or straight through globe valves as indicated. Valves 2" and smaller shall have screwed bronze bodies. Valves 2½" and larger shall have flanged iron bodies. Size all valves for full flow and with a maximum pressure drop of 5 PSI unless specified otherwise. All straight through water valves shall have equal percentage characterized plugs and be capable of shutting off against a minimum of 60 psi. Straight through valves 1" and smaller may be equal percentage characterized ball valves.

E. FLOW SWITCH: Vapor tight, packless construction with all wetted parts made of brass and designed for mounting in pipe tee. Paddle to have removable segments to accommodate required pipe size and flow. Switching action: single pole, double throw with a minimum rating of 7 amps at 120 volts. Mount switch in horizontal pipe.

F. FREEZESTATS: Low temperature cutout thermostats shall have a 20-foot element with response to lowest temperature sensed by any 1-foot section.

G. ACTIVE WATER FLOW DEVICES: Provide Onicon insertion, double turbine flow meter. Device shall be factory calibrated for use in designated pipe size. Overall accuracy shall be ±1% of absolute flow,

between 3ft/s and 30ft/s. Flow switch shall have integral hot tap design, for installation or removal without shutting down system.

H. TERMINAL BOX CONTROLLER: Digital control package with integral damper operator for mounting in box controller housing. Controllers shall be sent to the approved box manufacturer for factory installation.

I. DIFFERENTIAL PRESSURE AND PRESSURE SENSORS. Sensors shall have a 4-20 MA output proportional signal with provisions for field checking. Sensors shall withstand up to 150% of rated pressure, without damaging the device. Accuracy shall be within ±2% of full scale. All wet differential pressure sensors shall be installed with stainless steel tubing, or copper tubing with dielectric isolation.

J. HIGH STATIC LIMIT SWITCH: Switches shall be diaphragm operated with 3½" diaphragm to actuate a single pole double throw snap switch. Motion of the diaphragm shall be transmitted to the switch button by means of a direct mechanical linkage. It should include a 1.4 - 5.5" w.c. range pressure switch with manual reset snap switch.

K. STATIC PRESSURE SENSOR: Provide a differential pressure transmitter with a 4-20 ma and 0-10VDC output.
   a. Accuracy: ± 1% of range
   b. Ranges: 5.0"
   c. Operating temp range: 32°F to 125°F

L. WATER DIFFERENTIAL PRESSURE SWITCHES. Pressure switches shall have a repetitive accuracy of ±2% of range and withstand up to 150% of rated pressure. Sensors shall be diaphragm or bourbon tube design. Switch operation shall be adjustable over the operating pressure range. Install across all pumps if possible.

M. AIR FLOW SWITCHES: Flow switches shall have a repetitive accuracy of ±1% of their operating range. Switch actuation shall be adjustable over the operating flow range. Switches shall have snap-acting Form C contacts rated for the specific electrical application. Install per manufacturer's recommendations. Install delta P air flow switch on air handling units and fan coil units.

N. CURRENT SENSING RELAYS. Relays shall monitor status of motor loads. Switch shall have self-wiping, snap-acting Form C contacts rated for the application. The set point of the contact operation shall be field adjustable. Install on fans, cooling tower and vertical turbine pumps.

O. CONTROL RELAYS: Control relay contacts shall be rated for 150% of the loading application, with self-wiping, snap-acting Form C contacts, enclosed in dust proof enclosure. Relays shall have silver cadmium contacts with a minimum life span rating of one million operations. Relays shall be equipped with coil transient suppression devices.

P. SOLID STATE RELAYS (SSR): Input/output isolation shall be greater than 10 billion ohms with a breakdown voltage of 150 V root mean square, or greater, at 60 Hz. The contact operating life shall be 10 million operations or greater. The ambient temperature range of SSRs shall be 20°F-140°F. Input impedance shall be greater than 500 ohms. Relays shall be rated for the application. Operating and release time shall be 10 milliseconds or less. Transient suppression shall be provided as an integral part of the relays.

Q. AIR FLOW MONITOR: Provide an AFM comprised of one or more insertion probes assemblies per duct location. The AFM shall feature microprocessor based electronics, low flow sensitivity, true averaging velocity and temperature compensated velocity output. The output signal shall be available in 0-5VDC or 4-20 mA. Provide multiple probes and an electronics panel to average the flow of 2 to 8 probes based on duct size. Sensor Accuracy = ± 2%, Operating Temperature Range –20 to 160 degrees Fahrenheit, Max Pressure Drop (delta P) = .005 in. WG @ 2,000 fpm in a 12 x 12 in. duct, Probe Material – Aluminum 6063 TS2.

R. LIGHTING:
   1. EXTERIOR LIGHTING: Direct control by BAS through contactors. Contactors provided and installed by Division 26.
   2. INTERIOR COMMON SPACES: Local controls only by Division 26.

3. INTERIOR SMALL SPACES: Local controls only by Division 26.
4. Reference lighting drawings, details, schedules, and sequence of operations on electrical drawings for additional information.

S. ELECTRIC METER: Provide power meter for monitoring new main switchgear at each service entry. Meter, Integration and programming by Division 25. Installed by Division 26. Reference section 25 36 13 Integrated Automation Power Meters.

T. MISCELLANEOUS: Provide and install all relays, switches, and all other necessary devices required for a complete and satisfactory operating system.

U. CENTRAL PLANT I/O DEVICE: In the central plant provide a touch screen device to allow maintenance personnel override control of central plant equipment including adjacent air cooled chillers and cooling towers. System shall maintain safety interlocking to prevent damage to equipment, i.e. operating chiller without associated pump.

V. SMOKE DETECTORS: Detectors provided by the fire alarm subcontractor. Controls subcontractor shall wire the starter control circuit through the smoke detector auxiliary contact.

W. BACNET INTERFACE:
1. Provide interface to all devices as noted in sequence of operation for monitoring and control.

2.3 BUILDING AUTOMATION SYSTEM (BAS)

A. GENERAL REQUIREMENTS:
1. CONTRACTOR RESPONSIBILITY: The BAS Contractor shall be fully responsibility for the complete installation and proper operation of the Building Automation System equipment, sensors and controls devices. After the installation, the contractor shall be responsible for "debugging" and calibration of the BAS, including software for the duration of the warranty. All equipment shall be the latest standard design that complies with the specification. During the warranty period, Contractor shall monitor system from his office and provide assistance to Owner. Should software control schemes provide unsatisfactory operation, as determined by the Engineer during the warranty period, Contractor shall modify control schemes, set points, timing sequences or other software features to provide satisfactory operation as a part of his warranty package.
2. SYSTEM ARCHITECTURE: The system shall possess fully modular architecture that permits the expansion of the system through the addition of field modules, sensors and actuators. Module communications to be through a local area network (LAN). The central site system shall be used only as an interface to the LAN.
3. SYSTEM INTERFACE: Operator interface to the control system shall be graphical accessed through the internet. Provide district wide site map with each school listed and shown. Individual school controls system shall be viewed by selecting that school. The various systems, settings and operating conditions shall be viewed/modified though the various controls screens for that school.

B. GRAPHIC CONSTRUCTION:
1. COLOR VALUE: Space temperature and its deviation from zone set point shall be displayed on a floor plan map by color. These colors shall represent a defined temperature value and be implemented by the same standard throughout the entire system, including all graphic displays and parameter pages. The central site shall be able to display graphically, in up to 64 different colors, the following system information:
   a. General area maps shall show locations of controlled buildings in relation to local landmarks.
   b. Floor plan maps shall show heating and cooling zones throughout the buildings in a range of colors which provide a visual display of temperature relative to their respective set points. The colors shall be updated automatically without operator action. Set point adjustment and color band displays shall be operator definable. Floor plan maps shall also show the relative position of sensors and mechanical equipment. Each zone shall display the set point temperature and measured temperature. Provide room numbers and room names of controlled spaces and equipment locations consistent with the actual site names and numbers, not plan drawing names and numbers.
   c. Mechanical system graphics shall show the type of mechanical system components servicing any zone through the use of pictorial representation of components. It shall also provide a current

status of all I/O points being controlled and applicable to each piece of equipment including analog readouts in appropriate locations on the graphic representation of the set point and measured value.

d. All system graphics shall come programmed and require no owner modification. Individual graphics shall be as minimum the following:
   1) Complete chilled water piping system
   2) Complete condenser water piping system
   3) Complete hot water piping system
   4) Each chiller
   5) Each air handling unit
   6) Each zone of a multi-zone air handling unit
   7) Each VAV, CVT and double duct mixing box
   8) Main switchboard meter

2. INFORMATION ACCESS: The following information shall be selectable from a menu available on various graphics:
   a. Alarms Schedule graphs
   b. Message Schedule groups
   c. Module status Set points
   d. Programming parameters Trends
   e. Utilities
   f. Programming, scheduling and set point changes shall be accessible for modification of each menu for the associated equipment. Operator shall be able to automatically download changes to the appropriate program for the equipment being controlled. Operator shall be able to upload information from the field modules. In addition to having the ability to adjust set points on zones individually, the system shall allow the operator to make global set point changes that would take one command and automatically download it to the individual pieces of equipment and adjust their set points up or down by the operator defined deviation. A global command shall be able to be input that will automatically affect all installations connected to the network.

2.4 SPECIFIC GRAPHIC REQUIREMENTS

A. Data Format

1.	Temperature	Tenths	xx.x	ºF
2.	Percentage	Units	xx	%
3.	Amps	Units	xx	A
4.	Humidity	Units	xx	%
5.	Air Quantity	Units	xxxx	CFM
6.	GPM	Units	xxx	GPM

B. Main School Screen
1. Provide an overview of the entire building with color coding of zones based on temperature relative to set point, with light gray indicating zone is off. Green shall be area within set point tolerance, and varying shades of light to darker blue for lower than set point, and varying shades of light to dark red for higher than set point.
2. Clicking on an area of the building will change to a more detailed graphic of that area.
3. Provide table listing outside air temperature and RH percentage, and status for Fire Alarm, Security Alarm, Emergency Generator, Emergency Lighting Inverter, and Air Conditioning Emergency Shutdown.
4. Provide button to click to go to equipment and mechanical systems graphics.

C. Detailed Area Graphics
1. Individual zones shall be color coded base on temperature relative to set point, with light gray indicating zone is off. Green shall be area within set point tolerance, and varying shades of light to darker blue for lower than set point, and varying shades of light to dark red for higher than set point.
2. Label zone by AHU, AHU and Zone or AHU and DD/VAV Box as applicable with zone temperature listed.
3. Clicking on zone shall transfer to applicable AHU or DD/VAV box.
4. Provide button for each AHU serving this area that transfers to the AHU graphic.

5. Each piece of equipment shall be labeled and have a text indication whether it is ON, OFF or FAILED. Additionally, equipment that is ON shall have some graphical indication of its status, either by color or animation. Status shall be based on equipment status sensors, not condition of the enabling point.

D. Main Mechanical Room
1. Provide graphic showing mechanical room fans, unit heaters and purge systems.
2. Each piece of equipment shall be labeled and have a text indication whether it is ON, OFF or FAILED. Additionally, equipment that is on shall have some graphical indication of its status, either by color or animation. Status shall be based on equipment status sensors, not condition of the enabling point.
3. Each data point shall be displayed adjacent to an appropriate graphical symbol located in the proper position in the system.

E. Main Equipment Graphic
1. Provide composite graphic for the chilled water/condenser water system at the central plant. The ON/OFF condition of each chiller, pump and cooling tower shall be a color coded element of the equipment: gray OFF, blue ON, red failed. Additionally, equipment that is on shall have some graphical indication of its status by animation. Status shall be based on equipment status sensors, not condition of the enabling point.
2. Provide composite graphic for the heating water system at the central plant. The ON/OFF condition of each boiler and pump shall be a color coded element of the equipment: gray OFF, blue ON, red failed.
3. Provide buttons for each AHU and RTU that will transfer to the associated graphic.
4. Provide buttons for chilled water, condenser water and heating water systems that transfer to the associated graphic.

F. Chilled Water System Graphic
1. Provide graphic that shows the chilled water system including pumps and chillers. Chilled water shall be light blue for water returning to the chiller and dark blue for water supplied by the chillers.
2. Each piece of equipment shall be labeled and have a text indication whether it is ON, OFF or FAILED. Additionally, equipment that is on shall have some graphical indication of its status, either by color or animation. Status shall be based on equipment status sensors, not condition of the enabling point.
3. Each data point shall be displayed adjacent to an appropriate graphical symbol located in the proper position in the system. Include enable, status, alarm, run amps and % loaded for each chiller.

G. Heating Water System
1. Provide graphic that shows the heating water system including all pumps and boilers. Heating water shall be light red for return hot water and dark red for supply hot water.
2. Each piece of equipment shall be labeled and have a text indication whether it is ON, OFF or FAILED. Additionally, equipment that is on shall have some graphical indication of its status, either by color or animation. Status shall be based on equipment status sensors, not condition of the enabling point.
3. Each data point shall be displayed adjacent to an appropriate graphical symbol located in the proper position in the system. Include enable, alarm and status of each piece of equipment.

H. Air Handling Unit, Rooftop Unit and Fan Coil Unit Graphic
1. Provide graphic that shows all coils, valves and dampers. Outside air and return air shall be shown. For multizones, include graphic for each zone.
2. Each piece of equipment shall be labeled and have a text indication whether it is ON, OFF or FAILED. Additionally, equipment that is on shall have some graphical indication of its status, either by color or animation. Status shall be based on equipment status sensors, not condition of the enabling point.
3. Each data point shall be displayed adjacent to an appropriate graphical symbol located in the proper position on the graphic. Include enable, alarm and status of each piece of equipment.

I. Terminal Box
1. Provide individual graphic for each box and equipment.
2. Provide graphic that shows all coils, valves and dampers.
3. Each piece of equipment shall be labeled and have a text indication whether it is ON, OFF or FAILED. Additionally, equipment that is on shall have some graphical indication of its status, either by color or animation. Status shall be based on equipment status sensors, not condition of the enabling point.
4. Each data point shall be displayed adjacent to an appropriate graphical symbol located in the proper position on the graphic.

J. Fans and Unit Heaters
1. Equipment with local/room thermostat shall have graphic noting state of unit and associated space temperature.
2. Fans associated with a particular air handling unit shall be a part of the air handling unit graphic.

K. Main Switchboard and Service Entrance Meters
1. Provide individual graphical display of all monitored information and include historical trend graph with a user selectable historical range.
a. Each monitored item's data curve may be toggled on/off by the user.
b. Provide unique colors for each monitored item.
c. The date range to display shall be user selectable over any period up to a minimum of thirty (30) days. The default range shall be seven (7) days.

2.5 STAND-ALONE CONTROL UNIT (SCU):

A. DISTRIBUTED CONTROL: Each control unit shall be capable of full operation either as a completely independent unit or as a part of the building wide control system. All units shall contain the necessary equipment for direct interface to the sensors and actuators connected to it. Each control module shall be capable of stand-alone direct digital operation utilizing its own processor, memory, input/output, analog-to-digital conversion, clock (rechargeable battery backed for 30 days minimum) and voltage transient protection devices. No slave modules will be permitted.

B. MEMORY: The memory used in each module shall be non-volatile EEPROM type, which has read/write capability from the central site or local operator interface and does not lose its programs or operating data upon power failure. Each module shall have an automatic restart feature with sequencing after power failure and shall not require reloading at power up.

C. COMMUNICATION: To share global building data, such as outside air temperature, humidity and electric demand, modules shall be able to communicate with each other over a local area network (LAN). The system shall be capable of recognizing a failed module on the LAN and reporting the condition at the central site. If any module on the LAN fails or is powered down, it shall not inhibit the use of the LAN by other modules.

D. SCU FUNCTION:
1. CONTROL FORMS: All temperature control functions shall be executed within the SCU. Loop control shall be executed via direct digital control algorithms. The user shall be able to customize control strategies and sequences of control, and shall be able to define appropriate control loop. It shall be possible to fully create, modify or remove control algorithms within a specific unit while it is operating and performing other control functions. Input for these changes shall be made via the network form the central site computer or local operator interface.
2. ALARMS: Proof of equipment operating and alarm status shall be by positive feedback from the local control circuit as indicated on the Point List. The system shall have the capability of not only alarming abnormal OFF conditions of fans and pumps but shall also indicate abnormal ON condition of the same equipment. If a start command has not been issued from the central site and a piece of equipment is turned on, the central processor will alarm an abnormal ON. This abnormal ON shall also sound the audible alarm and display the alarm ON condition.
3. GLOBAL INFORMATION: The SCU's shall be able to share point information such that control sequences or control loops executed at one control unit may receive input signals from sensors connected to other SCU's within the network. If the network communication link fails or the other control units malfunction, the control loop shall continue to function using the last value received.
4. EMS FUNCTIONS: Each SCU shall be capable of performing the following energy management routines as a minimum:
a. Chilled or Heating Water Reset
b. Chiller Sequencing and Optimization, Lead/Lag
c. Duty Cycling (Temperature compensated)
d. Event Initiated Programs
e. Graphic Trend Analysis
f. Maintenance Management
g. Peak Demand Limiting
h. Source Optimization
i. Start/Stop Time Optimization

j. Supply Air Reset
k. Time of Day Scheduling
l. The building operator shall be able to manually restore all system programs from the central site hard disk.

2.6 SEQUENCE OF OPERATION

A. Refer to Section 25 95 10.

2.7 SUBSTANTIAL COMPLETION

A. The mechanical systems will not be declared substantially complete until the automatic temperature controls for that portion has been demonstrated to be complete and functioning as intended. Operation in manual mode is not acceptable. 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 set point.

B. Engineer shall have access to the control system graphics via the internet to review and evaluate control system operation.

END OF SECTION

SECTION 25 95 10

BUILDING AUTOMATION SEQUENCES OF OPERATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Mechanical Requirements as specified in Sections 23, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 23 00 00.

1.2 RELATED WORK

A. Section 25 00 00 – General Controls Requirements

B. Section 25 00 10 – Controls Closeout Requirements

C. Section 25 50 00 – Direct Digital Control System for HVAC

D. Section 28 46 00 – Fire Detection and Alarm

PART 2 - SEQUENCE OF OPERATIONS

2.1 GENERAL REQUIREMENTS

A. The energy management system shall monitor the building conditions 24 hours per day.

B. Systems with thermostats that control both heating and cooling shall be programmed to have an operator selectable dead band.

C. Chiller safety status point shall be wired so that the BAS recognizes all chiller panel alarms, chilled water proof of flow and condenser water proof of flow regardless of chiller staging. BAS shall be able to manually reset any alarm remotely to restart the chiller at the discretion of the operator, either by direct connection or through a BACNet interface.

D. Where air systems are designed to have economizer functions, provide an icon on the main building graphic that allows the operator to globally disable this function.

2.2 SYSTEM START/STOP

A. Each air handling unit or unitary equipment shall have an individual schedule of operation. If any equipment requires chilled water for cooling, chiller plant shall operate. If any equipment requires heating water for heating, heating water plant shall operate. System shall allow operator to selectively require more than one system to require cooling or heating for those systems to be energized.

B. When an air handling unit or other conditioning system is schedule on at a certain time, this means the space temperature setpoint is attained at that time. Unit shall be started prior to that time to initiate cool

down or warm up period. This start time shall be calculated based on interior conditions, outside air temperature and historical data of the inertia of the building.

C. Exhaust fans, supply air fans and supply air dampers shall not be operating/open during the cool down/warm up cycle. If an associated air handling unit is manually started, these fans and dampers shall also operate.

D. The system shall be programmed with a purge mode that will continue to provide ventilation air the building after the scheduled occupancy is passed. The purge mode shall be user adjustable and shall be set to a default of 2 hours. During purge mode, all AHU fresh air dampers, exhaust fans and supply air fans shall remain active. Space temperatures shall be reset to their unoccupied setback setpoints.

2.3 CHILLED WATER SYSTEM (VARIABLE PRIMARY)

A. If one or more air handling units are on and requesting cooling, chiller is energized. The chiller will use its internal controls to start/stop the integral chilled water pump.

B. The EMS shall constantly monitor the operation of the chillers and pumps. If a chiller or pump should fail, an alarm shall be sent operator's work station. The operator shall be able to override any sequence, set point, alarm or chiller/pump selection from the remote location.

C. The EMS shall calculate building tonnage based on interrogating each chiller and summing loads. Calculation shall be smoothed by time averaging.

D. Note that TAB will set primary speed to obtain proper flow quantities. EMS shall use these settings to control pumps, not 60 Hz.

E. Chiller Manager Control Points:

1. Building CHW Supply	AI (Temperature)
2. Building CHW Return	AI (Temperature)
3. Primary CHW Return	AI (Temperature)
4. System Control Differential Pressure	AI (Pressure)
5. Chilled Water Flow Rate	AI (GPM)

F. Each Chiller Control Points:

1. Chiller Energize	DO
2. Chilled Water Differential Pressure	AI (Pressure & Calculated GPM)
3. Chiller Supply Water Temp Setpoint	AO (Temperature)
4. Chiller Supply Water Temperature	AI (Temperature)
5. Chiller Operating Capacity	AI (Percentage/Tons)
6. Chiller Failure Status	DI (Alarm Point)
7. Chiller Alarm Reset	DI
8. CHS Temperature out of tolerance	Calculated Alarm Point
9. Chilled Water Pump Status	DI
10. Chiller Run Time	Calculated Report Point

G. Each Chiller BacNet Control Points

1. Chiller Alert & Alarm Readout	Read (Alarm/Alert Code)
2. Chiller Operating Capacity	Read (Tons)
3. Chiller Flow Switch	Read (Status)
4. Chiller EWT	Read (Temperature)
5. Chiller LWT	Read (Temperature)
6. Condenser EWT	Read (Temperature)
7. Condenser LWT	Read (Temperature)
8. Chiller Suction Temp	Read (Temp, each circuit)
9. Chiller Discharge Temp	Read (Temp, each circuit)
10. Chiller Discharge Pressure	Read (Pressure, each circuit)
11. Alarm Relay Status	Read (Status)
12. Alert Relay Status	Read (Status)
13. Machine Operating Hours	Read (Hours)

14. Compressor Starts	Read (Start Number, each compressor)

2.4 HEATING WATER SYSTEM – FIELD HOUSE

A. If any air handling unit is on and requesting heat, or three or more VAV boxes are on and requesting heat, the boiler system shall be energized. The boilers shall modulate and stage as required to maintain the scheduled return water temperature. The boiler system pumps are constant speed and shall stage with the boilers using the boilers integral control logic.

B. Return water setpoint shall be 70°F if outside air temperature is above 70°F. Return water temperature setpoint shall be raised based on outside air temperature until it is 160°F at 27°F outside. If three more hot water control valves are at 100% and cannot maintain leaving air temperature setpoints, the return water temperature setpoint shall be increased in 5°F increments every 15 minutes until all hot water valves are at 95% open or less.

C. When there is no longer a request for heat, the boiler system shall be de-energized.

D. The Boilers have integral temp reset capability. Controls contractor shall coordinate with Mechanical contractor for programming of temp reset.

E. If outside air temperature is less than 30°F, the heating water system shall start.

F. The EMS shall constantly monitor alarm contact provided with the boiler.

G. Boiler Management Control Points:

1. System Enable	DO
2. Boiler Status, Each	DI
3. Pump Status, Each	DI
4. System Return Water Setpoint	AO (Temperature)
5. Boiler Supply Water, Each	AI (Temperature)
6. System Supply Water	AI (Temperature)
7. System Return Water	AI (Temperature)
8. System Return Water out of tolerance	Calculated Alarm Point
9. Boiler Capacity, Each	AI (% Fire)
10. Boiler Alarm Failure Status	DI (Alarm Point)

H. Boiler BacNet Control Points:

1. Boiler Alert & Alarm Readout	Read (Alarm/Alert Code)
2. 12 Owner Chosen Points (TBD)	Read

2.5 VAV AIR HANDLING UNIT WITH SUPPLY AND EXHAUST TERMINAL BOXES (AHU-1,2,3)

A. The EMS shall control both supply and exhaust flow rates for each space, as well as temperature, based on a preset occupancy schedule and monitoring active occupancy of each space.

B. Exhaust Control:
1. The EMS shall maintain a building occupancy schedule.
2. When the building is unoccupied, the exhaust valves for each space shall be set to their unoccupied, minimum flow setpoint.
3. When the building is occupied, the exhaust valves for each space shall be set to their occupied, minimum flow setpoint. The EMS shall enable active occupancy monitoring.
   a. The control system shall monitor each space for active occupancy status through an interlock with the lighting control system occupancy sensor.
   b. If the active occupancy state for any space is true, while the occupied state is active, the exhaust flow rate shall modulate to the maximum value. When the active occupancy state switches back to false, the exhaust flow rate shall modulate back to its minimum occupied value.
4. Each exhaust fan shall monitor the system pressure and modulate to maintain the exhaust static pressure setpoint. Set point is adjustable and determined by T&B.

C. Temperature Control:
   1. Unit shall be controlled by DDC controller that shall receive start/stop signal from the central EMS. If the unit is scheduled to be on and cooling is required, fan shall start. Associated outside air damper or fan shall start/open to preset position based on occupancy schedule or override condition. Chilled water valve shall modulate to maintain 54°F leaving air temperature. Associated VAV boxes shall be enabled. If building temperature is less than 65°F, associated VAV boxes shall be enabled and heat the spaces to above 65°F before starting enabling chilled water valve.
   2. The control system shall modulate the fan to maintain a set duct pressure, as measured by a static pressure sensor located approximately 2/3 of the longest duct run from the AHU. The EMS shall monitor all the VAV box cold air damper positions and reset the static pressure setpoint, so that it is no higher than required to have one box at 95% open and all others less open. Duct pressure sensor located in duct shall limit fan speed through variable frequency drive to limit static pressure to 3.5" wc, and send alarm to the operator's workstation.

D. Any time the outside air/return air mixed temperature falls below 35°F, supply fan shall be de-energized, chilled water valve opened, system chilled water pump energized, building heating water pump energized and outside air damper closed.

E. Outside air fan or damper shall close on loss of signal, loss of electric power or when AHU fan is off.

F. Fan status shall be based on differential pressure sensors.

G. Fire alarm system shall disable fan through VFD interlock when in alarm, and send alarm to the operator's workstation.

H. Safety devices and circuits such as low limit thermostats, high limit thermostats, fire alarm contacts and high pressure cutout shall operate whether the starter is in Auto or Hand position.

I. Associated VAV boxes shall maintain zone set point temperatures by modulating cold air damper and sequencing on heating coil valve. Minimum setting of cold valve shall be adjustable with initial set point as indicated on the equipment schedule. CVT fans shall run constantly when box is enabled. Parallel terminal fans shall run only during heating.

J. Exhaust Control Points:

1. Active Space Occupancy, Each	DI (Occ Sensor Interlock with Div26)
2. Fan VFD, Each	AO (RPM)
3. Fan Status, Each	DI
4. Duct Static Pressure, Each System	AI (Pressure)
5. Exhaust Valve Flow, Commanded	AO (CFM)
6. Exhaust Valve Flow, Actual	AI (CFM)
7. Exhaust Valve Damper, Position	AI (%)
8. Exhaust Air Setpoint, Active Occupancy	Data Point
9. Exhaust Air Setpoint, Building Occupancy	Data Point
10. Exhaust Air Setpoint, Unoccupied	Data Point

K. Make-up Air Control Points:

1. Fan VFD, Each	AO (RPM)
2. Fan Status, Each	DI
3. Duct Static Pressure, Each System	AI (Pressure)
4. Supply Valve Flow, Commanded	AO (CFM)
5. Supply Valve Flow, Actual	AI (CFM)
6. Supply Valve Damper, Position	AI (%)
7. Building Air Balance Offset, CFM	Data Point
8. Supply Air Setpoint, Calculated CFM	Data Point

L. AHU (VAV Unit) Control Points:

1. Fan VFD	AO (RPM)
2. Fan Status	DI
3. Chilled Water Valve	AO
4. Heating Water Valve	AO

5. Duct Static Pressure	AI (Pressure)
6. Supply Air Temperature	AI (Temperature)
7. Entering (Mixed) Air Temperature	AI (Temperature)
8. Smoke Detector/Firestat	ALARM POINT
9. Fan Status	DI
10. Supply Temperature out of tolerance	Calculated Alarm Point
11. Run Time	Calculated Report Point

M. Each VAV Terminal Control Points:

1. Unit Enable	DO
2. Zone Temperature	AI (Temperature)
3. Supply Air Temperature	AI (Temperature)
4. Primary Air Supply	AI (CFM)
5. Primary Air Damper	AO
6. Heating Coil Valve	AO
7. Maximum Primary Air Setpoint	Data Point
8. Minimum Primary Air Setpoint	Data Point

2.6 SINGLE ZONE FOUR PIPE UNITS WITH VFD DRIVE AND REHEAT COILS (AHU-4)

A. Unit shall be controlled by DDC controller that shall receive start/stop signal from the central EMS. Controller shall monitor cooling coil leaving air temperature and modulate chilled water valve to maintain leaving air temperature set point. Controller shall monitor space temperature and vary fan speed between maximum and minimum setpoints to maintain space temperature. Once minimum setpoint speed is reached, heating coil valve is opened to maintain space temperature. If heating valve is fully open and additional heating is required, increase fan speed.

B. Based upon the space humidity sensor/control, EMS shall incrementally open heating valve over time to maintain the humidity setpoint. The cooling sequence will remain in operation, keeping constant cooling coil LAT and modulating the fan speed to maintain space temperature. If fan speed has reached 95% of maximum speed, heating valve shall be prevented from opening further.

C. Based upon the space CO2 sensor reading, the associated ventilation air supply valve shall be modulated closed to maintain the CO2 setpoint. Once the ventilation air has reached its minimum setpoint, it shall be prevented from closing further.

D. Associated outside air fans/dampers shall be interlock with unit operation but operate only during occupied times, or during a ventilation purge sequence.

E. Fan status shall be based on differential pressure sensors.

F. Fire alarm system shall disable fan through starter interlock when in alarm.

G. Safety devices and circuits such as low limit thermostats, high limit thermostats and fire alarm contacts shall operate whether the starter is in Auto or Hand position.

H. Note that TAB will set fan speed with VFD to set maximum air quantities. EMS shall use these settings as maximum settings for variable air quantities.

I. AHU Controls Points:

1. Fan VFD	AO (RPM)
2. Fan Status	DI
3. Zone Temperature	AI (Temperature)
4. Zone Humidity	AI (Humidity)
5. Zone CO_2	AI (CO_2)
6. Chilled Water Coil Valve	AO
7. Heating Water Coil Valve	AO
8. Pre-Heat Coil Water Valve	AO
9. Pre-Cool Coil Water Valve	AO
10. ACCU	AO (Stages)

11. Supply Air Temperature	AI (Temperature)
12. Entering (Mixed) Air Temperature	AI (Temperature)
13. Smoke Detector/Firestat	ALARM POINT
14. Supply Temperature out of tolerance	Calculated Alarm Point
15. Run Time	Calculated Report Point

2.7 EXHAUST FANS AND OUTSIDE AIR DAMPERS

A. Outside air dampers/fans and exhaust fans are individually opened based on occupancy schedule and override condition.

B. Fans with local switch (kitchen fans & student range hood fans) shall operate only if switch is on and scheduled to be on. See wiring diagram on the drawings

C. Control Points:

01	Fan/Dampers	DO
02	Fan Status	DI

2.8 TOTAL BUILDING AIR BALANCE:

1. The EMS shall monitor the total exhaust flow through all associated exhaust terminals (ETs) and exhaust fans.
2. The EMS shall monitor the total ventilation air flow through all associated the ventilation terminals (VTs) and supply fans (SFs)
3. The EMS shall monitor the operational status of the commercial dryers by utilizing controls transformers. Each dryer, when energized, shall account for 1200 cfm of exhaust air. Refer to control schematic drawings.
4. The EMS shall modulate the supply air to the AHUs as needed to maintain a positive or neutral pressurization.
    1) Order in which to modulate supply air to building:
        i. VT.2/AHU-2
        ii. VT.1/AHU-1
        iii. VT.4/AHU-4
        iv. VT.3/AHU-3

2.9 INITIAL SYSTEM SET POINTS

Room Temperature	72° F
Chilled Water Temperature	44° F
Heating Water Temperature	180° F
VAV Air Unit Leaving Air Temperature	53° F
Humidity Sensors	55%
Duct Pressure Control Level	1.5” wg
Duct Pressure Safety Limit	3.5” wg
CO_2 Senor	1000 ppm

END OF SECTION

SECTION 26 00 00

GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

1.2 GENERAL REQUIREMENTS

A. Provide all supervision, labor, equipment and materials required for the installation of complete and operating electrical systems in the building. Pay all fees and obtain all permits related to construction activities and utility service installation.

1.3 DRAWINGS AND SPECIFICATIONS

A. GENERAL: Drawings and Specifications are intended to be complimentary. Any work described in either of them, will be work required under this contract. Where there is a conflict in the Drawings and Specifications it shall be clarified by RFI. Barring clarification prior to bidding the most expensive option shall be included and clarification shall be made during construction. Should any work required by the drawings and specifications be in violation of any Federal, State, County or City laws, ordinance or regulation, those laws and regulations shall prevail, and shall be complied with by the Contractor as a part of this work with no extra compensation.

B. EQUIPMENT AND DEVICE LOCATION: The drawings indicate approximate locations of the various items of electrical systems. These items are shown approximately to scale and attempt to show how these items should be integrated with building construction. Locate all the various items by on-the-job measurements, conformance with Contract Documents and cooperation with other trades. Refer to Architectural Drawings that may locate devices relative to casework or devices provided by other contractors. The drawings are schematic in nature and are not intended to show exact locations of conduit, but rather to indicate distribution, circuitry and control.

C. CEILING DEVICES: All light fixtures, speakers and other ceiling devices shall be located to conform to the ceiling grid system as shown on the Architect’s reflected ceiling plan. Examine all drawings to become familiar with this requirement. In no case should fixture locations be determined by scaling drawings. Lighting fixtures in mechanical spaces are shown in their approximate location only. Do not install light fixtures until mechanical piping and ductwork is installed. At that time install lights in a location to provide best lighting.

D. MINOR RELOCATION: In certain instances, the Architect may require minor relocation of outlets, switches, etc. of up to five (5) feet. If Contractor is informed of necessary relocation before work is begun on this portion of the job, no extra compensation will be allowed.

1.4 REQUIREMENTS FOR ALL MATERIALS

A. U. L. LABEL: All materials must be new and of good quality and shall bear the stamp of approval of the Underwriters' Laboratories, Inc. (U. L.). Equipment and materials shall be used and installed consistent with the U. L. testing and U. L. requirements.

B. MISCELLANEOUS ACCESSORIES: Provide all parts and accessories necessary for a complete installation for the systems and equipment specified.

C. HAZARDOUS MATERIAL: All materials shall be certified to not contain any asbestos, PCB's or other material banned by the Environmental Protection Agency.

1.5 INSTALLATION REQUIREMENTS

A. COORDINATION: The Contractor shall cooperate with other trades on the job and make installations in the proper sequence during the construction of the buildings, and he shall notify the Architect well in advance of construction of all interference of his work with that of other trades and of building construction. This notification shall not relieve the contractor of his responsibilities to coordinate his work with the total project. Where various items of equipment and materials are specified and scheduled, the purpose is to define the general type and quality level, not to set forth the exact trim required to fit the various types of ceiling, wall or floor finishes. Provide materials which will fit properly the types of finishes actually installed.

B. BASIS OF DESIGN: Equipment that is scheduled is the basis of the design and has been coordinated for space, installation and electrical requirements. Equipment and models from other acceptable manufacturers have not been verified or coordinated and may vary from scheduled equipment. Contractor shall verify these requirements prior to using other equipment in his bid and include any additional costs for installation of the substitute equipment. Confirm electrical installation requirements of equipment provided by other trades prior to installation. Incorrectly installed materials shall be replaced at no cost to the Owner.

C. WORKMANSHIP: All work shall be performed in a neat workmanlike manner and in the best practice of the trade. Only workmen skilled in the trades shall be employed to perform the work included in these specifications.

D. EQUIPMENT PROTECTION: Do not deliver equipment to jobsite until it is actually needed for installation. Protect equipment from damage due to construction activities and the weather. Equipment allowed to stand in weather will be rejected and Contractor is obligated to furnish new equipment at no cost to Owner.

1.6 ALTERNATES

A. Determine the scope of each specified alternate proposal by carefully reading all Divisions of the Documents. The Bid Form contains information explaining the extent of the construction to be performed under a specific alternate. Alternate proposals, which are not predominantly electrical in scope, are described in other Divisions of these Documents.

1.7 CODES

A. All materials and their installation shall be in accordance with the National Electrical Code, local building codes and the National Safety Code. Nothing in the plans and specifications shall be construed to permit work not conforming to the most stringent of the codes. Particular attention shall be paid to the U. L. codes for fireproofing of conduit, electrical devices and light fixtures that are part of or pass through fire rated ceilings, walls, and floors.

1.8 VISITING THE SITE

A. The Contractor shall be familiar with the Drawings and Specifications and shall have examined the premises and understand the conditions under which he will be obligated to operate in performing the contract. No allowance shall be made consequently for any error through negligence in this regard.

1.9 ELECTRICAL SERVICE

A. GENERAL: Obtain (during the bidding period) from the Power Company all required information to provide a complete electrical service installation as shown on the Drawings.

B. SERVICE: The service characteristics are 480Y/277V, 3 phase, 4 wire. The Power Company is Entergy.

C. SERVICE ENTRANCE: Provide bus-type weatherhead, bus-type CT/meter, service rack, pad for pad mounted transformer, cable tap box, protective bollards or other special construction as required by the Power Company. Refer to Power Company standards.

D. FEES: Refer to Architectural Sections for requirements.

1.10 TEMPORARY SERVICE

A. Provide a temporary electrical service for construction power. Size and voltage as required for construction activities as specified by the General Contractor. Construction site distribution shall be overhead and comply with the latest NEC and OSHA Standards and the current edition of the National Electrical Safety Code (NFPA 70e) for safety in the workplace. Remove all temporary wiring upon project completion.

B. Pay all fees, charges, and installation costs charged by the Power Company for temporary service for construction power and its removal.

C. Where the Owner allows the use of the building permanent service for construction activities the contractor shall pay all fees, kilowatt hour charges, etc. related to its use.

1.11 GUARANTEE

A. All materials, apparatus and equipment furnished and installed under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner. . All extended warranties shall be from the date of acceptance by the Owner regardless of when the equipment was delivered to the job site or started up by the contractor.

1.12 SUBMITTALS

A. All submittals shall be submitted in PDF form. Submittal will be reviewed with comments incorporated in this PDF. After final approval, Contractor shall provide a hard copy for use at the project site.

B. The purpose of these submittals is to attempt to aid the contractor in such a manner that improper or unacceptable materials are not delivered to or installed on the job. Shop drawings shall be approved before installation of the material under consideration. Approval of these submittals shall not be construed as releasing the Contractor from compliance with the Contract Documents. All materials and equipment shall be subject to final acceptance by the Engineer at completion of construction.

C. Equipment and material submittals must show sufficient data to indicate complete compliance with contract documents as follows:

01 Proper sizes and capacities.

02 That the item will fit in the available space in a manner that will allow proper service.

03 Floor plans, elevations, wiring diagrams, etc. necessary to verify proposed installation.

D. Catalog data must be clearly marked to indicate the item or model number being submitted and must include all specified accessories. All information on a catalog sheet not pertaining to the item being submitted must be marked out.

E. All submittals shall include a table of contents listing all items in that specific submittal. All submittals on the project need not be submitted in PDF. The front sheet of each copy of the submittal shall have the following typed information:

01 Job name and location.

02 General Contractor's name, address, project manager's name and telephone number.

03 Submitting Sub-contractor's name, address, project manager's name and telephone number.

04 Supplier's company name, address, salesman's name and telephone number.

F. For any item to be installed in or on a finished surface (such as tee bar acoustical ceiling, plaster wall), Contractor certifies by making the submittal that he has checked all applicable contract Documents and that the item submitted is compatible with the surface finish on which it is to be installed.

G. Submit shop drawings and/or brochures as indicated in individual sections and for:

Panelboards Transformers

Circuit Breakers Disconnect Switches Surge Protection Devices

Light Fixtures	Lighting Controls	Time Clocks
Wiring Devices	Phase Loss Monitors	Low Voltage Controls
PMT Service Entrance		
Generator	Automatic Transfer Switches	
Coordination Study		

H. Major equipment in AHU/Mechanical/Electrical Rooms will not be approved until contractor has submitted and received approved 1/4" scale coordination drawings of mechanical and air handling unit rooms showing sizes of proposed equipment, including access space, and mechanical and plumbing equipment also located in the room.

I. If a submittal is returned to the Contractor marked "Rejected" or "Revise and Resubmit", only one (1) additional submittal will be permitted without the Contractor incurring charges for the additional re-submittals. SEG shall be reimbursed by the Contractor for any expense in connection with any necessary submission in addition to the two (2) submissions allowed. Contractor will be billed by SEG at a rate of $125/hr for these occurrences.

1.13 SUBSTITUTIONS

A. The names of manufacturer and model numbers have been used in the Contract Documents to establish types of equipment and standards of quality and are intended to be the Basis of Bid. No attempt has been made to determine if each manufacturer listed for a particular item of equipment will produce material that will comply with all requirements. If only one manufacturer is named for a specific item of equipment (except lighting fixtures), the specified manufacturer will be the only acceptable one. Where more than one manufacturer is named for a specific item of equipment, only one of these manufacturers will be considered for approval. Where only one manufacturer is mentioned with the phrase "or approved equal", Contractor may submit an alternate manufacturer as outlined in Special Conditions and this Article. If a submittal contains sufficient information to prove compliance with the Contract Documents, then that submittal will be acceptable.

01 ALTERNATE LIGHT FIXTURES: Alternate light fixtures may be submitted but a substitute fixture must be equal from the standpoint of materials, construction and performance. Request for substitution must be accompanied by complete data and descriptive sheets during the bidding period as described in these documents.

B. All other brands, including any additional names which may be listed as "Alternates" or "Approved Equal" must conform with the specifications, size, accessories, etc. of the first named brand and be subject to Paragraph D and E of this Article. Alternate equipment must be equal from the standpoint of materials, construction and performance. Request for substitution must be accompanied by complete data and descriptive sheets during the bidding period as described in Paragraph D and E of this Article.

01 Submitted on Bidder's letterhead attached to Proposal Form with individual deductive amounts stipulated and the documentation required in Paragraph E-03.

02 All savings for Owners selection of deductive amounts by acceptance of alternate or substituted items are to be paid to the Owner.

C. All equipment within common group or category (e.g. switchgear, lighting fixtures, fire alarm, etc.) shall be same manufacturer.

D. Proposed Substitutions/Approved Equals:

01 Submitted no less than 14 calendar days prior to bid date.

02 Submit proposed substitutions with catalog data and/or manufacturer's shop details indicating all modifications required to conform with specified brand. Include all relevant items necessary to make a determination of equal status or submittal shall be deemed incomplete and rejected.

03 If submittal contains sufficient information to prove compliance with the Contract Documents, then that alternate submittal will be acceptable. Approved submittals for bidding purposes only will be published by addenda.

E. Substitutions with prior approval:

01 Submitted on Bidder's letterhead attached to Proposal Form with individual additive/deductive amounts stipulated and the documentation required in Paragraph B-2.

02 Owner reserves the right to accept or reject any or all substitution proposals before execution of Contract.

03 Provide all design/engineering services required to make adjustments 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.

1.14 FOUNDATIONS AND EQUIPMENT SUPPORTS

A. GENERAL: Provide all foundations and supports.

B. CONCRETE HOUSEKEEPING PADS: 4" high concrete pad to be provided under Division 3, for all floor mounted equipment including but not limited to switchboards, transformers, inverters, and similar equipment provided by Division 26. Concrete pads shall be sized for the equipment to be supplied. Pad shall exceed base dimensions by approximately 4" all around. Reinforce pads with 6" x 6" woven wire mesh and #4 bar around perimeter. Tool pad to form chamfered edge. Coordinate sizes and locations with the General Contractor.

C. OUTDOOR ELECTRICAL EQUIPMENT: Provide structural pad to support pad mounted transformers, outdoor switchgear and generators. Provide galvanized pipe or angle iron structure to support weatherheads, meters, and outdoor protective devices and disconnect switches. Provide bollards to protect equipment installed in traffic areas.

D. INSIDE ELECTRICAL EQUIPMENT: Securely attach panels to block walls with concrete bolts. When attaching to sheetrock or other less substantial walls, provide blocking and unistrut cross supports to securely attach panel to structural members. Where panels are required to be freestanding provide angle iron support structure bolted to floor and building structure.

E. VIBRATION ISOLATION: Install dry type transformers on four waffle pad type isolators.

1.15 NOISE

A. Eliminate any abnormal noises which are not considered by the Architect to be an inherent part of the systems as designed. Abnormal buzzing in equipment components will not be acceptable.

1.16 TESTING BY CONTRACTOR

A. GENERAL: All wiring, instruments, apparatus and equipment shall be tested for continuity, ground and short circuits before the circuits are energized. For 120 Volts circuits, the neutral/s may require disconnecting. A complete record of all testing shall be submitted to Owner at completion.

B. GROUND TESTING: The resistance of the grounding system to ground shall not exceed 3 ohms for water pipe ground or 6 ohms for driven ground rods. If tests indicate a higher value, additional ground rods shall be installed to reduce the resistance to a value of 6 ohms or less. Whenever connection is required to an existing ground conductor, tests shall be made before connection to ensure that the existing ground conductor is unbroken and continuous. Testing shall be in accordance with generally accepted practice.

C. INSULATION TESTING: Test all electrical equipment bussing, underground feeders and feeders 1/0 and larger at 85% of rated insulation value. Insulation tests shall be made with a 500 volt "Megger" as manufactured by James G. Biddle Company or equal. Test one conductor at a time with other two grounded. Attempt to raise voltage to maximum in one minute. Do not exceed 2 MA. Polarization Index (amps ratio - 1 minute/10 minutes) to be at least 3 unless approved otherwise.

D. INFRARED SCANNING: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard, switchboard, switchgear, automatic transfer switches, and splices in cables/conductors No. 3 AWG or larger. Remove box and equipment covers so equipment interiors and splices are accessible to the portable scanner.

01 Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard and splice in cables/conductors No. 3 AWG or larger no more than eleven (11) months after date of Substantial Completion or one (1) month before the end of the warranty period whichever is sooner.

02 Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values and produce a thermal image of the tested location. Provide calibration record for device.

03 Record of Infrared Scanning: Prepare a certified report that identifies locations/equipment checked and that describes scanning results. Include images generated by thermal scanner, notation of deficiencies detected, remedial action taken, and observations after remedial action.

E. GROUND PENETRATING RADAR: Where concrete flooring or paving must be cut to install MEP systems, contractor shall take measures to prevent damaging existing underground services. Contractor shall utilize ground penetrating radar and electrical circuit tracing equipment in the area to be excavated to determine the existence of underground services. When saw cutting, limit the depth of the cut to less than the thickness of the concrete. Breakout the concrete manually with special care in areas of possible underground services.

F. ADDITIONAL TESTING: The Contractor shall make such other tests as required by the Authority Having Jurisdiction (AHJ) or as may be or become necessary to assure satisfactory operation of each unit device or equipment.

1.17 CLOSEOUT REQUIREMENTS

A. AS-BUILT DRAWINGS: Obtain a set of project drawings and keep these at jobsite during construction. During the course of construction, mark on these prints any changes which are made, noting particularly locations for those items which will need to be located for servicing. At completion of job, mark each sheet "Record Drawings", date and deliver to Architect.

B. OWNER'S INSTRUCTIONS: Provide the following periods of instruction for each site to the Owner's designated personnel upon completion of the system's installation. Provide additional training as noted in individual equipment specifications.

01 Reference 260010 Closeout Requirements.

C. CLOSEOUT MANUALS:

01 Reference 260010 Closeout Requirements.

1.18 MOUNTING HEIGHTS

A. GENERAL: Heights are measured to centerline from the finished floor. Where devices are located in block walls Architect may require height to be adjusted so junction box is in a desired relationship with the mortar joint. Device must still be mounted within the acceptable height range for ADA. Where a height is not listed below, refer to the architectural drawings. Where no heights are given, submit RFI prior to rough-in.

B. DEVICE:

Light switch	46"
Receptacle	18"
Receptacle at counter	7" above countertop or horizontally in backsplash
	Coordinate with architectural drawings, do not mount in tackboards, markerboards, etc.
Receptacles in Kitchens	Per the Food Service drawings.
	Where additional devices are shown on the electrical drawings without a specified height clarify per RFI.
Hand dryers	Coordinate j-box rough-in with approved equipment. Refer to architectural drawings for elevations.
Data outlet	18"
Data outlet at counter	7" above countertop or horizontally in backsplash
	Coordinate with Architectural Drawings, do not mount in tackboards, markerboards, etc.
Telephone outlet	18"

Telephone outlet at counter	7" above countertop or horizontally in backsplash Coordinate with Architectural Drawings, do not mount in tackboards, markerboards, etc.
Wall telephone	46”
Wall mounted AP	Reference Technology Drawings
A/V Plates	Reference Technology Drawings
A/V Display Boxes	Reference Technology Drawings
Volume Control	46”
Wall Clock outlet	Reference Technology Drawings
Indoor wall sound speaker	Reference Technology Drawings
Outdoor bells or speakers	Reference Technology Drawings
Wall exit light	Bottom 4" above door frame or 96"
Wall Pack Lights	Reference Elevations and Architectural Drawings
Security Keypad	Reference Technology Drawings
Card Reader	Reference Technology Drawings
Video Intercom Wall Station	Reference Technology Drawings
Wall Mounted Motion Sensors	Reference Technology Drawings
Wall Mounted Cameras	Reference Technology Drawings
Fire Alarm Control Panel	Confirm with Owner
Fire alarm pull station	46"
Fire alarm notification device	82" or on ceiling
Remote Annunciator	Confirm with Owner

1.19 ELECTRICAL INSPECTIONS

A. GENERAL: Contractor shall request inspections to review any and all electrical installations. Inspections shall include but not be limited to: system tests, grounding tests, underground installations prior to backfill, rough-in installations, wall cover inspections, above ceiling inspections, final inspection.

B. GOVERNMENTAL INSPECTIONS: Contractor shall test and demonstrate systems, allow for Engineer and Owner inspections, and correct all punch list items before arranging for inspections from the Fire Marshall or other final “Certificate of Occupancy” inspection requirements. This will require that the contractor complete systems in a timely manner to meet construction schedules.

C. Contractor shall provide a MINIMUM of 48 hour notice prior to requested inspection time, no exceptions.

D. INSPECTION REPORTS: After each inspection, SEG will generate an inspection report and distribute promptly. The Contractor will then be given 7 working days from date of report to address all deficiencies listed on the report. The GENERAL CONTRACTOR shall verify that all items on each inspection report have been addressed by their subcontractors in this time period. Once verified the GENERAL CONTRACTOR shall sign-off on each deficiency listed on the report and return the signed-off copy of the inspection report to SEG via e-mail. After the signed-off report is returned to SEG, the GENERAL CONTRACTOR shall request a re-inspection by SEG to close the report. If after 7 working days no re-inspection is requested by the GENERAL CONTRACTOR to close a report, SEG reserves the right to re-inspect whenever our schedule allows, with these re-inspections still being subject to Paragraph E below.

E. TEST REJECTIONS AND RE-INSPECTIONS: If a test is rejected or a re-inspection of an issued SEG Inspection Report is found to NOT be completely addressed, only ONE (1) additional inspection will be permitted without the Contractor incurring charges for each additional inspection required. SEG shall be reimbursed $1000 by the GENERAL CONTRACTOR for expenses in connection with EACH inspection in addition to the two (2) re-inspections allowed.

1.20 COMMISSIONING AND TEST AND BALANCE

A. Third party commissioning and an independent test and balance contractor are a part of this project. Commissioning agent and T&B contractor will be under a separate contract directly with the Owner. Refer to included specifications for commissioning and T&B.

B. Electrical contractor shall complete the pre-function checklist for the various electrical devices. Checklists will be supplied by the commissioning agent.

C. Electrical contractor shall perform system tests as required by the commissioning agent in addition to any that are described in these specifications.

1.21 DEMOLITION AND REMODELING

A. In areas of demolition, contractor shall remove all electrical devices, conduit and wiring not to be reused. Any material that has salvage value shall be offered to the Owner, and if accepted, delivered to his warehouse or other designated location. If not accepted it shall be properly disposed of with the other construction debris.

B. Resupport, rehang, and rebundle existing conduit and cabling to remain. Rework existing circuits and installation to accommodate for renovation/demolition work including but not limited to changes in ceiling heights, ceiling types, and wall locations. Group cabling by type/trade and all materials shall be properly supported per applicable codes and standards.

C. Where partial circuits or systems are to be reused, ensure that they remain active. Where existing equipment is removed and reinstalled or replaced with new equipment, modify, extend and relocate existing feeder and other wiring, and connect to equipment. Relocate conduit as necessary to allow new or modified construction. Repair existing electrical systems damaged by construction activities.

D. Remove and replace ceilings as necessary to install or modify electrical systems.

E. Where ceilings are removed or replaced, remove and reinstall lights, speakers, security devices, fire alarm devices and other existing electrical and low voltage devices in the ceiling. Any low voltage cabling laying on ceilings shall be supported from structure per applicable codes and standards. Segregate fire alarm and security from other cabling.

F. Where existing adjustable circuit breakers are to be reused, adjust for revised loads. Where existing fused switches are to be reused, replace fuses with proper size for revised loads. Where new circuit breakers are to be installed in existing panels, verify that the circuit breaker will fit in the allotted space. Provide NEMA 1 enclosure installed adjacent to panel and wire connect to bussing if there is insufficient space.

G. Where light fixtures are to be replaced or added in existing areas, verify and coordinate existing voltages with fixtures to be supplied prior to ordering fixtures.

H. Where auxiliary systems such as fire alarm, security, data, sound, etc, interface with existing equipment that is replaced or modified (mechanical, electrical or plumbing), disconnect and reconnect these systems.

END OF SECTION 26 00 00

SECTION 26 00 10

ELECTRICAL SYSTEMS CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

PART 2 - MATERIALS AND METHODS

2.1 CLOSEOUT REQUIREMENTS

A. AS-BUILT DRAWINGS: Obtain a set of project drawings and keep these at jobsite during construction. During the course of construction, mark on these prints any changes which are made, noting particularly locations for those items which will need to be located for servicing. At completion of job, mark each sheet "Record Drawings", date and deliver to Architect.

B. CLOSEOUT MANUALS: At completion of job, furnish three copies of spare parts lists, operating instructions, product cutsheets, test results, manufacturer's studies/settings/reports and as-builts for all equipment furnished under this Division. These lists and instructions shall be published by the manufacturer of the equipment. Bind in 3-ring binders with project name. Provide a USB flash drive with a digital copy of complete closeout manual with each binder.

01 DOCUMENTATION:

a. Lighting Controls
   (i) Complete device and equipment documentation.
   (ii) As-built drawings indicating device layout, wiring, and sequence of operations.
   (iii) As-built relay panel drawings/schedules indicating lighting zones.
   (iv) Owner operation memo generated for end user training.
   (v) Warranty information.

b. Switchboards, panelboards, low voltage circuit protective devices, and transformers.
   (i) Complete device and equipment documentation.
   (ii) User manuals on any meters, surge protectors, or other specialty devices.
   (iii) As-built panelboard drawings/schedules.
   (iv) As-build feeder routing and sizing.
   (v) Electrical systems coordination study, including letter from manufacturer or installer certifying breaker settings have been programmed per the coordination study results.
   (vi) Electrical systems ground testing report.
   (vii) Insulation testing report.
   (viii) Infrared scanning report.
   (ix) Warranty information.

c. Wiring Devices
   (i) Complete device and equipment documentation.

d. Low Voltage Circuit Protective Devices
   (i) Complete device and equipment documentation.

e. Low Voltage Controllers
   (i) Complete device and equipment documentation.

f. Packaged Generator and Automatic Transfer Switches

(i) Complete device and equipment documentation.
(ii) User manuals.
(iii) Test data.
(iv) Device settings and any associated studies.
(v) Generator load bank test report
(vi) Warranty information.

g. Surge Protective Devices
(i) Complete device and equipment documentation.
(ii) Warranty information.

h. Lighting
(i) Complete device and equipment documentation.
(ii) Warranty information.

i. Exterior Athletic Field Lighting
(i) Complete device and equipment documentation.
(ii) As-built drawings indicating device layout, wiring, equipment connections, and measured as-built lighting levels.
(iii) Warranty information.

j. Division 27:
(i) Refer to Division 27 sections.

k. Division 28:
(i) Refer to Division 28 sections.

02 TRAINING SESSIONS:

a. Provide digital copy of each recorded training session with digital turnover documents.

03 TESTING:

a. 260000 – Building insulation testing report
b. 260000 – Building ground testing report
c. 260000 – Network grounding backbone testing report
d. 260000 – Building infrared scanning report
e. 263213 – Generator load bank test report
f. 265568 – Measured sports lighting levels

04 SPARE PARTS:

a. Deliver all spare parts and loose items to the Owner at the end of the project. Provide a spare parts list and signed transmittal listing all items with closeout documentation.

05 WARRANTY:

a. Provide manufacturer's warranty information, including any extended warranties included in the project.
b. Provide warranty letter from each contractor and sub-contractor.
c. Provide copy of extended service contracts, if any, included in the project.

2.2 GUARANTEES, WARRANTIES, AND SERVICE CONTRACTS

A. GENERAL FOR ELECTRICAL SYSTEMS: All materials, apparatus and equipment furnished and installed under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner unless noted to have extended warranties.

B. NETWORK LIGHTING CONTROLS:

01 System warranty shall be for one (1) year of complete maintenance coverage after final acceptance of the system and include all material and labor to provide consistent peak performance of the system. Post-warranty maintenance shall be available on contract or call basis.

02 Provide a five (5) year complete manufacturer's warranty on all products to be free of manufacturers' defects.

C. PACKAGED GENERATOR:

01 Provide five (5) year or 1500 hour operation, non-prorated, parts and labor warranty for the generator from the date of Substantial Completion using the Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.

a. For standby power applications, the complete electrical power system (generator set, controls and associated switches, switchgear and accessories), as provided by the single-source manufacturer, shall be warranted by said manufacturer against defects in materials and workmanship for the above warranty period.

b. Said coverage shall include parts, labor, travel expenses, and labor to remove/reinstall said equipment.

c. There shall be no deductibles applied to said warranty.

02 Provide one (1) year service contract that includes monthly visits to observe and record condition, and verify generator “exercise” programming is operational. Generator exercise schedule shall be coordinated with Owner’s personnel for day and time.

D. AUTOMATIC TRANSFER SWITCHES

01 Provide five (5) year, non-prorated, parts and labor warranty for the transfer switch system.

E. SURGE PROTECTIVE DEVICES

01 Ten (10) year, non-prorated, full replacement.

F. LIGHT FIXTURES:

01 Five (5) year warranty on LED boards, drivers, and components.

02 Two (2) year warranty with startup and training on Remote Inverters.

G. EXTERIOR ATHLETIC FIELD LIGHTING:

01 Ten (10) years from the date of final sign-off.

H. DIVISION 27:

01 Refer to Division 27 sections for additional information.

I. DIVISION 28:

01 Refer to Division 28 sections for additional information.

2.3 SPARE PARTS

A. GENERAL: Upon completion of the installation, deliver to the Owner all tools and spare parts that are furnished by the Equipment Manufacturer for use with the equipment furnished under this Contract. Include a spare parts list and signed transmittal with closeout documents.

B. Reference individual specification sections for additional information.

C. LIGHTING CONTROLS

01 Power Packs (3 of each type)

02 Occupancy Sensors (3 of each type)

03 Occupancy Sensor Switches (3 of each type)

04 Low Voltage Switches (3 of each type)

05 Emergency Bypass Controllers (3)

D. LIGHT FIXTURES:

01	Emergency Power Packs (Interior)	Two (2)
02	Emergency Power Packs (Exterior)	Two (2)
03	Exit Signs to be installed as single or double sided	Two (2)

E. DIVISION 27:

01 Refer to Division 27 sections for additional information.

F. DIVISION 28:

01 Refer to Division 28 sections for additional information.

2.4 TRAINING

A. All training sessions for specific systems equipment (Generator/ATS, Network Lighting Controls, etc.) shall be recorded and the recordings be included in the closeout materials.

B. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans and closeout documentation.

C. GENERAL: Base electrical systems eight (8) hours with video recording.

01 Provide training/demonstration with video recording. Material covered shall include:

a. Maintenance of equipment.
b. Locations of equipment.
c. Locations of in-ground junction boxes.
d. Underground conduit.
e. EM lighting inverters.
f. Specialized or unique equipment.
g. Network grounding backbone.

D. LIGHTING CONTROLS:

01 Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.

02 6 Hours (2 hours on site for staff and 4 hours for maintenance personnel)

E. GENERATOR & EM POWER SYSTEMS:

01 4 Hours (2 hours to general staff and 2 hours to maintenance personnel)

02 Set exerciser schedule as directed by Owner's representative.

F. EXTERIOR ATHLETIC FIELD LIGHTING:

01 Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.

02 8 Hours (4 hours on site for staff in 2 hour blocks and 4 hours for maintenance personnel)

G. DIVISION 27:

01 Refer to Division 27 sections for additional information.

H. DIVISION 28:

01 Refer to Division 28 sections for additional information.

2.5 SCHEDULED WARRANTY ITEMS

A. After 10 months but no more than 11 months from Owner acceptance the contractor shall perform:

01 A warranty walk with the Owner, Owner's Representative, Architect, and Engineer and correct any identified items.

B. Perform an Infrared scan of the electrical systems as indicated in 260000 General Electrical Requirements, generate a report to be reviewed by the Engineer, and correct any identified items.

C. LIGHTING CONTROLS:

01 After 90 days from occupancy the factory authorized representative and electrical contractor shall re-calibrate all sensor time delays and sensitivities to meet the Owner's Project Requirements. Provide a detailed report to the Architect/Owner of all re-commissioning activity and changes.

END OF SECTION 26 00 10

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

1.2 RELATED WORK

A. Section 26 05 26 – Grounding and Bonding for Electrical Systems

B. Division 27 – Communications Systems

C. Division 28 – Electronic Safety and Security Systems

D. Section 28 31 00 – Fire Detection and Alarm Systems

1.3 GENERAL INSTALLATION REQUIREMENTS

A. All electrical work dealing with electrical circuits or power requirements of 110 volts or higher shall be performed by a licensed journeyman electrician supervised by the designated master electrician of record.

01 A licensed electrical contractor and its designated master electrician of record is responsible for supervision of all licensees performing work on behalf of the contractor to assure compliance with applicable statutes and rules and in particular, standards of conduct set out in the Texas state Electrician Administrative Rules.

02 It may be necessary for the designated master electrician of record to be present on-site as required the Authority Having Jurisdiction, Owner, Architect, Engineer, or construction issues that may arise and shall be done at no additional cost to the Owner.

B. All cables not installed in conduit shall be plenum rated.

C. All conductors and cable shall be properly labeled at both ends and at any intermediate splice.

D. All low voltage cables shall be installed in continuous length without splice.

E. All miscellaneous plenum rated cables shall be supported from and near structure with nylon straps or D-rings. Refer to individual specification sections for additional requirements. Do not weave through joists for support. All exposed cabling, and cabling above inaccessible ceilings shall be installed in raceway.

F. Install conduit sleeves with protective grommets for all wall penetrations for plenum rated cables.

G. Seal all sleeve and conduit penetrations of walls with grout or hardening caulk, suitable for wall material, to mechanically attach sleeves to the wall. Provide fire rated sealant at fire rated walls.

H. In areas of remodeling, remove all conduit and wire that is not to be reused. Resupport existing conduit and wire to remain.

I. Provide grounding bushings for all connections at concentric and eccentric knockouts, and where reducing washers are used.

J. All junction boxes and other devices above ceiling that may require maintenance shall be located within 18” of the ceiling.

K. Where light fixture switches are shown together, they shall be installed in a common junction box and faceplate.

L. Where receptacles and/or data outlets are shown grouped, install close together. Provide Caddy TSGB16, RBS16 or equal mounting bar for sheetrock walls to accomplish this.

M. All exterior junction boxes in the ground shall be concrete type with traffic rated tops.

N. All junction and pull boxes shall be marked noting electrical circuits and relay circuits of wiring within the box. Circuit labels shall be written on the cover in black permanent marker and shall be readable from the floor level without removing the cover. Additionally, junction box housings shall be color coded as follows.

01 J-boxes and covers in finished spaces shall be painted to match. Write circuit number on inside of j-box cover.

02 J-boxes and covers in unfinished spaces accessible to the public such as welding shops, HVAC labs, automotive shops, etc. shall be painted to match.

a. Write circuit number on outside of j-box cover.

b. Write circuit number on inside of j-box cover where paint color is too dark to maintain readability of marker labeling.

03	Emergency and Exit Circuits:	Red
04	Normal Power 120V/208V/240V:	Blue
05	Normal Power 277V/480V:	Yellow
06	HVAC Controls:	Green

07 Do not paint the covers except in finished spaces.

O. Where concrete flooring or paving must be cut to install MEP systems, contractor shall take measures to prevent damaging existing underground services. Contractor shall utilize ground penetrating radar and electrical circuit tracing equipment in the area to be excavated to determine the existence of underground services. When saw cutting, limit the depth of the cut to less than the thickness of the concrete. Breakout the concrete manually with special care in areas of possible underground services.

PART 2 - MATERIALS AND METHODS

2.1 RACEWAY SYSTEMS

A. REQUIRED: Complete raceway systems for all wiring. This includes, but is not limited to feeders, branch circuit wiring, low voltage lighting controls, temperature controls wiring, data cabling, video cabling, sound systems wiring, security systems wiring and fire alarm system wiring. Generally auxiliary system and controls wiring is plenum rated so conduit system would consist of junction boxes and conduit in walls, above inaccessible ceilings and sleeves through walls. Control and interlock wiring shall be provided under the Mechanical Section. Refer to technology drawings for conduit sizes and locations for technology and security systems.

B. SLEEVES

01 Provide sleeves for all wiring passing through walls, floors not on grade and roof slabs.

02 Sleeves shall be sized with maximum 40% conduit fill.

03 Sleeves through floors shall be increased one trade size with a minimum size of 2” to provide spare capacity for the future.

04 Floor slab sleeves shall extend minimum 3" above floor level. Fully grout and seal the penetration around the sleeve to prevent water from entering the space below. Grouting shall form a 1” curb above floor level around the sleeve.

05 Sleeve interiors through floors and through fire walls shall be fire caulked or otherwise protected to maintain the fire rating of the wall.

B. LOW VOLTAGE CONDUIT:

01 Conduit, j-boxes, and pull boxes shall be provided by the Division 26 contractor for installation of low voltage devices and cabling. Refer to other sections and the drawings for specialty box requirements.

02 Minimum size conduit for data shall be 1”.

03 Minimum size conduit for audio/video cabling shall be 1.25”.

04 Where conduits for low voltage cabling are installed above grade they shall utilize the following radius bends and 90 degree factory elbow to exit the wall.

a. Minimum bend radius for copper cabling shall match a standard radius factory elbow:

Above Grade Low Voltage Copper Cabling Conduit Minimum Bend Radius			
Conduit Size	Bend Radius	Conduit Size	Bend Radius
3/4"	4.5”	2”	9.5”
1”	5.75”	2.5”	10.5”
1.25”	7.25”	3”	13”
1.5”	8.25”	4”	16”

a. Minimum bend radius for fiber cabling shall match a long radius factory elbow, equal to or exceeding the fiber bend radius:

Above Grade Fiber Conduit Minimum Bend Radius			
Conduit Size	Bend Radius	Conduit Size	Bend Radius
3/4"	12”	2”	24”
1”	12”	2.5”	24”
1.25”	24”	3”	36”
1.5”	24”	4”	36”

b. Final section of the elbow shall be no higher than 18” above the ceiling and be flat/horizontal.

c. Provide a single piece, protective, nylon bushing on the end of all low voltage conduits. Split bushings shall only be acceptable where there are existing cables to be protected or with prior written approval.

02 Where conduits for low voltage cabling are installed below grade they shall utilize a large radius sweeps.

a. Minimum bend radius shall be:

Below Grade Low Voltage Conduit Minimum Bend Radius			
Conduit Size	Bend Radius	Conduit Size	Bend Radius
3/4"-2”	24”	2.5”-4”	36”

C. RACEWAY CAPACITY: It shall be the Contractor's responsibility to determine the correct sizes of all types of raceway, to be installed, as instructed in the NEC and all applicable Codes. Runs of underground conduit longer than 80 feet shall be one size larger than NEC requirement, 4" maximum.

D. INSTALLATION:

01 LOCATION: Conceal all raceway systems in ceilings, walls and floors, except feeders serving equipment in mechanical and electrical equipment rooms, and in such other areas as indicated where conduit may be exposed. Keep conduits at least 8" away from any heat producing items.

a. Do not install conduit below grade or in floor slabs unless there is no other way to conceal conduit.

b. Equipment feeders in mechanical rooms or mechanical yards shall be run above grade.

c. Conduits in mechanical yards shall be routed overhead to the equipment being served in a manner that maintains access and does not interfere with equipment, piping, devices, etc. Conduits may be mounted on the underside of piping supports provided by the mechanical contractor.

d. Major feeders from switchboard to distribution panels or electrical panels may be run underground where they consist of either:

1) Single runs containing 4/0 or larger wire

2) Parallel runs of 3/0 or larger.

e. Do not install conduit on roof unless specifically shown to be on the roof or authorized in writing by the Engineer.

f. All junction and pull boxes above accessible ceilings shall be mounted so that the access panel is no higher than 18” above the ceiling.

02 ROUTING: Conduit shall be installed parallel to building coordinates, except for underground feeders from panel to panel may be installed in the most direct manner except where indicated on the drawings. Install all horizontal conduit at structure unless mounted to a wall.

03 EXPOSED RACEWAY: Run parallel to walls, ceiling or structural members, in a manner to present a neat appearance. Before installation, explain to the Inspector the proposed method of routing and obtain his approval. Hold all horizontal conduit at ceiling or structure, unless mounted on wall. Exposed conduit visible in public and finished spaces shall be painted to match.

04 SUPPORT: Provide adequate and sturdy support for all parts of raceway system.

a. Conduit concealed in walls or slabs may be supported with wire hangers, provided they are of heavy gage and spaced to give adequate strength.

b. Exposed conduit must be supported with materials specifically made for this purpose; do not use wire hangers.

c. Do not attach any parts of raceway system to air conditioning ducts or ceiling systems.

d. Wiring above ceiling without conduit shall be supported from structure or wall with J hooks, cable rings, or other manufactured devices designed for this service.

e. Unless described by detail on the drawings, provide Tolco Pipe Pier, Caddy Pyramid, Eaton Dura-Blok or similar strut based supports four feet on center to support conduit on the roof. Select for proper weight loading. Confirm with other trades that conduit supports are compatible with the roofing system prior to installation.

f. Provide Eaton Dura-Block strut based supports four feet on center to support conduit on or above Avadek or similar fluted canopies. Align support with and place in the bottom flute. Select for proper weight loading. Equal strut based supports with integral drainage channel shall also be acceptable.

05 CONTINUITY: Make all joints and connections in a manner which will ensure mechanical strength and electrical continuity. Use double locknuts and insulated bushings for rigid

conduit, and insulated type connectors for EMT conduit 1” and larger for connections to boxes. Use insulated grounding bushings wherever connection is subject to vibration or moisture, such as near mechanical equipment, when internal ground wire is installed, and when concentric or eccentric knockouts are encountered, as well as where reducing washers are used.

06 PULL BOX LOCATIONS: As required by the National Electrical Code and utility provider requirements.

07 EXPANSION FITTINGS: Install O. Z. or equal expansion fitting in each run of conduit which crosses a building expansion joint, and in all runs longer than 200 feet.

08 CORROSION PROTECTION: For all non-coated metal raceway in contact with concrete or mortar, tape with 3M corrosion protective tape, or equal. Tape shall extend for approximately 6" before entering and after exiting concrete. Conduit through slabs at grade shall be PVC coated rigid galvanized steel.

09 PULL WIRE: Install nylon pull cord in all low voltage raceway systems and empty electrical power raceway systems.

10 OPENINGS: Keep all raceway openings closed in a manner to prevent entry of moisture and foreign materials until conductors are installed.

11 FIRE PROOFING: All power and low voltage raceway components passing through or installed within U. L. fire rated walls, ceiling or floor structures shall be fireproofed in the manner prescribed by the U. L. Fire Resistive Index and local building codes. All penetrations shall be fireproofed with 3M Fire Barrier CP25WB caulk, moldable putty or FS-195 wrap/strip installed per the manufacturer's recommendations.

12 ACOUSTICAL CONTROL: Provide moldable putty installed per manufacturer’s recommendations for acoustically sensitive or sound critical locations.

a. Examples of acoustically sensitive locations:

1) Libraries

2) Conference Rooms

3) Recording studios

4) Music Halls

5) Performing arts spaces

6) Clinics

7) Counselors offices

8) And similar spaces where noise transfer from one space to another is not desirable.

b. Nelson FSP Firestop Putty, STI Putty & Putty Pads, 3m Moldable Putty Pads, ATS Acoustical Putty Pads, or approved equal.

13 SEALING: All conduit, junction box, outlet box and other penetrations of the building envelop shall be sealed with non-hardening caulking or other non-hardening material as required by the International Energy Conservation Code.

E. MANUFACTURERS: All components of raceway systems must bear U. L. label.

2.2 CONDUIT

A. CONDUIT TYPES

01 RIGID GALVANIZED STEEL – Threaded fittings

02 PVC COATED RIGID GALVANIZED STEEL - All PVC coated rigid galvanized steel conduit shall comply with UL 6 and NEMA No. RN-1 standards and meet ASTM D870 and ASTM D2247 testing requirements. Provide PVC coated couplings, fittings and pulling

elbows matching the installed conduit.

a. Plasti-Bond REDH2OT with ETL Verified PVC-001 label

b. Perma-Cote with ETL Verified PVC-001 label

c. KorKap with ETL Verified PVC-001 label

d. Or approved equal with ETL Verified PVC-001 label.

03 PVC CONDUIT – Schedule 80

04 EMT – Steel conduit

a. Provide steel compression fittings.

b. Provide insulated throat watertight fittings where conduit is exposed to dampness inside building.

05 FLEXIBLE METAL CONDUIT – Greenfield, galvanized steel conduit for field installation of conductors (maximum 24”)

06 LIQUID TIGHT FLEXIBLE METAL CONDUIT – SealTite Type UA galvanized steel conduit with PVC waterproof coating for field installation of conductors (maximum 24” long except light fixtures up to 72”)

a. LFMC in food production areas, kitchens, food production splash zones and wash down areas, food processing, meat packing, restaurants, poultry packing, pharmaceutical facilities, and similar areas shall incorporate a bacteria growth inhibiting PVC jacket that may be cleaned without degredation to the jacket bleaching agents.

1) AFC SZ

b. Liquid-Tuff by Kaf-Tech or AFC shall also be acceptable.

07 MC CABLE

a. Flexible steel or lightweight steel conduit with factory installed, stranded, color coded copper conductors, green insulated ground wire and polypropylene sheath/tape. Aluminum armored MC-lite shall not be acceptable. Armor exterior shall be color coded for contained conductors/voltage identification. Conductor insulation shall be 600V, 90°C rated and color coded to match the building standard color coding.

1) AFC MC Tuff.

2) Equal by Kaf-Tech shall also be acceptable.

08 SURFACE RACEWAY – Plastic raceway, paintable white finish, and mechanically connected to walls or casework. Type based on application. (only allowed where specifically noted on the drawings)

a. Legrand Wiremold, Panduit Pan-Way, or approved equal.

B. TYPE OF CONDUIT FOR VARIOUS LOCATIONS:

01 UNDERGROUND: Rigid galvanized steel or Schedule 40 PVC.

a. Conduit in contact with concrete shall be PVC coated, rigid galvanized steel.

b. Install PVC coated, rigid galvanized steel, long radius elbows where conduit turns up to grade including straight length section to a minimum of 6” above grade/concrete slab or extended to final equipment connection, whichever is greater.

c. Encase underground electrical feeder carrying 480V or greater not under building slab or vehicular paving in a 3" red concrete envelope located a minimum of 24" below finished grade to top of envelope (48" if above 600 volts) and extending a minimum of 24” beyond the slab/pavement. Provide detectable tracer tape installed on top of red concrete. Where more than one conduit is installed in the same trench, provide manufactured conduit support spacers to organize conduit

and ensure proper concrete encasement. Notify Inspector for inspection of duct bank at least 24 hours prior to concrete placement.

d. Conduits located below the building slab or vehicular paving do not require concrete encasement except where indicated on the drawings or where required by code or utility requirements.

1) Conduit passing under sidewalks shall require encasement.

e. Conduit for telephone, data, etc. does not require concrete encasement except where indicated on the drawings or where required by code, or utility requirements.

f. Conduit depth:

1) Do not run any conduit within the slab. All conduit shall be run beneath the slab with penetrations made under slab and through to space above.

i Conduit 1” and smaller may be run just under the concrete.

ii Larger conduit shall be minimum 24” below finished floor.

2) All electrical feeders outside the building shall be installed 4ft to the top of the encasement or ductbank.

3) Electrical service feeder/ductbank shall be installed 4ft to the top of the encasement.

4) Miscellaneous circuits, including site lighting circuits, outside the building shall be installed at ~3ft using a Ditch Witch or equivalent trenching equipment.

5) Low voltage and technology conduit outside the building shall be installed at ~3ft using a Ditch Witch or equivalent trenching equipment.

i Low voltage and technology conduits may be run in the same trench as electrical conduits while maintaining minimum 1ft above electrical conduits and a minimum cover of 2ft.

6) Where electrical and civil/plumbing underground is in conflict, civil/plumbing installations shall have priority. Electrical and technology conduit depth shall be increased or decreased to eliminate conflict while maintaining minimum cover of 2ft.

g. All underground conduit bends and 90s shall be long radius sweeps.

1) Minimum 24” radius for power.

2) Refer to low voltage conduit radius tables in this document.

h. Provide detectable tracer tape located 6” above underground conduits with identifying markings and colored per APWA color-code:

1)	Electrical Power	Red
2)	Low Voltage	Orange

02 IN POURED CONCRETE WALLS: PVC coated, rigid galvanized steel or Schedule 80 PVC. Install PVC coated rigid steel fittings on PVC conduit prior to conduit exiting concrete.

03 IN MASONRY WALLS: Galvanized steel EMT with steel, watertight compression fittings.

04 EXPOSED OUTSIDE OF BUILDING: Rigid galvanized steel. For conduit in mechanical courtyard within 50 feet of a cooling tower provide PVC coated, rigid galvanized steel conduit and fittings. Do not use EMT, IMC or PVC conduit.

a. Conduit under overhangs, canopies, open air structures, and similar spaces shall be considered exposed outside of the building.

05 INSIDE OF BUILDING: IN CEILING CAVITIES OR IN DRY WALL TYPE

CONSTRUCTION: Galvanized steel EMT or rigid galvanized steel.

06 INSIDE OF BUILDING: IN EXISTING CEILING CAVITIES, IN EXPOSED FLOOR OR ROOF STRUCTURE AREAS, OR IN DRY WALL TYPE CONSTRUCTION: MC cable with ground wire may be used to serve receptacles and light switches in existing sheetrock walls only. MC cable must not extend more than 24" into ceiling cavity and be connected to a junction box of the rigid conduit system. All MC must be vertical drops within the same wall cavity, no horizontal runs of MC shall be allowed.

07 EXPOSED ON MASONRY IN SHOP AREAS:

a. Below 10ft or where subject to physical damage: Rigid galvanized steel

b. Above 10ft: Galvanized Steel EMT

08 EXPOSED IN UNFINISHED OPEN FLOOR OR ROOF STRUCTURE AREAS

a. Galvanized steel EMT or rigid galvanized steel.

09 EXPOSED ON EXISTING MASONRY OR PLASTER WALLS IN FINISHED AREAS (only where specifically noted on the Drawings):

a. For electrical devices provide Panduit Pan-Way LDPH power rated surface raceway consistent with fill capacities, paintable white finish, plastic raceway complete with various boxes, devices, offsets and transitions for a complete electrical system installation.

b. For data systems provide Panduit Pan-Way LD10 Series or larger low voltage raceway consistent with cabling requirements, paintable white finish, plastic raceway complete with various devices, offsets and transitions for a complete low voltage system installation.

c. Provide Panduit Pan-Way T-45 two compartment if both data and power wiring are installed together to a single device.

d. All raceway shall be mechanically fastened to walls or cabinets. No tapes or glues allowed.

e. Equal by Legrand Wiremold shall be acceptable.

10 IN CONCRETE SLABS: Do not install conduit in concrete slabs.

11 FLEXIBLE METAL CONDUIT CONNECTIONS: Use only for connection to lights, motors and transformers from rigid conduit system. Do not loop flexible conduit between light fixtures or receptacles. Provide liquid tight construction and fittings in wet, damp or outside areas. Connections to mechanical equipment in main mechanical or boiler room, and kitchen equipment shall be in liquid tight. Do not install liquid tight flex inside an air handling unit room. Minimum length shall be 18". Maximum length shall be two feet except light fixture whips may be up to six feet.

12 LIGHT FIXTURE WHIPS: MC cable or 1/2" Greenfield Flex Conduit not to exceed six feet in length.

13 CONDUIT SLEEVES THROUGH WALLS AND FIREWALLS: EMT extending a minimum of 3" beyond wall with protective bushing at each end. Size to handle cabling with a maximum of 40% fill.

C. MINIMUM CONDUIT SIZE: 3/4"

D. FITTINGS:

01 RIGID CONDUIT: All rigid galvanized steel conduit shall have threaded fittings with insulated bushings.

02 EMT CONDUIT: Provide insulated bushings for all EMT conduit 1" or larger or housing #6 or larger wires.

03 GROUNDING: Provide fitting with grounding lug where conduit attaches to a painted box (disconnect switch, starter, transformer case, etc.), conduit attaches to a box through a knockout which has an associated larger knockout or a reducing washer is used, or conduit contains a feeder from switchgear to switchgear or between switchgear and

transformer.

04 TELEPHONE, DATA AND LOW VOLTAGE CONDUIT: Provide protective bushing on the end of telephone, data, sound system or other low voltage conduit stubbed into the ceiling cavity.

a. Bridgeport 90° Insulated Bushings

b. Bridgeport Mighty-Rite Split Bushings

c. Raco Specification Grade Insulated Bushings

d. Raco Universal Split Insulating Bushings

e. Or approved equal.

E. SPARE CONDUIT: Provide five empty 1” conduit from all recessed electrical panels to empty wireway above the nearest accessible ceiling.

F. LOW VOLTAGE CONDUCTORS: Low voltage conductors may be run in accessible ceilings without conduit. Provide conduit sleeve with protective end fittings through all walls and floors where raceway system is not installed. All exposed conductors shall be in conduit. All splices shall be in supported junction boxes. Low voltage conductors installed without conduit shall be independently supported on ring hangers, and plenum rated. Low voltage conductors for audio and data wiring shall be stranded unless otherwise recommended by the manufacturer.

01 All conduit bends and 90’s for technology conduits shall be long radius sweeps.

a. Refer to low voltage conduit radius tables in this document.

02 Provide protective end fittings on all low voltage conduits.

2.3 PULL BOXES

A. REQUIRED: Pull boxes, junction boxes, wiring troughs and cabinets wherever required for proper installation of various electrical systems.

B. ABOVE GRADE CONSTRUCTION: Made of code gage steel with sides formed and welded, screw covers unless shown to have hinged doors. Hinged doors to be same as furnished on panel boards, with same locking device. Knockouts shall be factory made or formed in field with a cutting tool which will provide a clean, symmetrically cut hole. Do not gang boxes or use extension rings to increase capacity. Boxes outside shall be steel NEMA 3 Type. Pull boxes near cooling towers shall be PVC coated aluminum or stainless steel.

C. UNDERGROUND CONSTRUCTION: Underground enclosures shall be Hubbell Quazite series underground enclosure, UL listed and manufactured by Lenoir City, Inc. Equal underground enclosure manufactured by CDR with ETL verification shall also be acceptable. Enclosures, boxes and covers are required to conform to all test provisions of the most current ANSI/SCTE 77 “Specification for Underground Enclosure Integrity” for ANSI Tier 22 applications for both covers and boxes. All covers are required to have the tier level rating embossed on the surface with 2 bolts. In no assembly can the cover design load exceed the design load of the box. All components in an assembly (box & cover) are manufactured using matched surface tooling. Independent third party verification or test reports stamped by a registered professional engineer certifying that all test provisions of this specification have been met are required with each submittal. Electrical contractor shall provide proper size of underground enclosure to coordinate with the conduits and feeders per national electrical code.

2.4 OUTLET BOXES

A. REQUIRED: For all switches, light fixtures, receptacles and the various other outlets shown.

B. CONSTRUCTION: Galvanized steel, one-piece construction, in all cases suitable for intended use. Provide "gang" boxes where devices are shown grouped. Use hot dipped galvanized cast iron for floors or exterior locations. Boxes outside shall be steel NEMA 3 Type.

C. TYPES FOR VARIOUS LOCATION:

01 CEILINGS: 4" square, 2-1/8" deep.

a. All devices installed in lay-in ceilings shall have bracket to support device from ceiling tees.

b. Caddy Heavy Duty T-Grid Box Hanger or equal.

02 DRY WALLS: Standard galvanized switchbox, gangable for multiple switches or receptacles. Provide 4" square, 2-1/8" deep galvanized switch box (1900) where additional volume is required for wiring. Provide shallow boxes where necessary. Provide Caddy TSGB16, RBS16 or equal mounting bar to fully support and align box with studs.

03 MASONRY WALLS: Galvanized switch boxes designed especially for masonry installations. Depths of boxes must be properly coordinated for each specific installation. Box shall be installed within 1/8” of surface of block.

a. Raco Block-Loc

b. Or approved equal.

04 FLOOR: Watertight, adjustable, cast iron.

05 SURFACE MOUNTED: Boxes surface mounted on walls or floor shall be Bell, cast aluminum box with appropriate plate and threaded hubs.

06 SPECIALTY:

a. Flush Mounted Boxes for A/V outlets:

1) Provided and installed under Division 26. Refer to drawings for specialty box requirements.

2) 2-gang shall have minimum 2-1.25” knockouts/lugs. 3-gang shall have minimum 1-1.25”, 1-1” and 1-3/4” knockouts/conduits/lugs. Provide number of gangs as indicated/required.

i Hubbell HBL260, HBL263

ii Raco 260, Raco 260H, Raco 263

iii Or approved equal.

3) Provide all mounting hardware as required.

b. Recessed Wall Mounted Boxes for wall mounted displays, electronic signage and similar installations:

1) Provided and installed under Division 26. Refer to drawings for specialty box requirements.

c. Recessed Wall Mounted Boxes for teacher and presenter stations.

1) Provided and installed under Division 26. Refer to drawings for specialty box requirements.

d. Ceiling AV Boxes for Projectors:

1) Provided by Division 27 and installed under Division 26. Refer to drawings for specialty box requirements.

e. Pedestal Mounted Receptacles (PMR) or Devices (PMD):

1) Inside Building:

i Above floor, cast aluminum housing suitable for line and low voltage devices.

ii In kitchens, washdown areas, or similar spaces where water may pool on the surface the PMR/PMD shall be installed ~2” above finished floor. The gap beneath the PMR/PMD shall be filled with grout and the finished floor brought up to the bottom of the housing using a matching transition piece.

iii Single Service Pedestals:

a. Basis of Design: Legrand 525 Series Service Fittings

b. Raco 6300/6301

c. Hubbell SC3098A/SC3099A

d. Hubbell FR80AL

e. or approved equal.

iv Specialty Outlet Single Service Pedestals:

a. Shall only be allowed where all of the standard single service pedestal devices are of insufficient size to fit the necessary NEMA, California Standard, or similar specialty device.

b. Hubbell SA6685G/SA6686G

c. Hubbell SA6687G/SA6688G

d. or approved equal.

2) Exterior Receptacle Pedestals:

i Direct burial, single gang, with hinged cover. Welded heavy gauge 304 Stainless Steel construction with powder coated finish. Finish to be selected by architect.

a. Leviton 1BH42-xx

f. Floor Boxes: Refer to 26 27 26 Wiring Devices.

g. Outlet Boxes in Corrosive Areas: Where PVC Coated conduit is required, provide compatible PVC coated cast aluminum box by the conduit manufacturer.

D. MOUNTING PLATES: Boxes mounted in casework or drywall construction shall have extension plates matched to casework/wall thickness so the box can be mounted flush with the metal stud and the wiring device mounts flush with the casework/wall surface.

E. BACK-TO-BACK OUTLETS: Outlets shown back-to-back on the drawings are to be installed with a minimum of 6" of lateral separation between outlets for minimum sound transmission, grouping outlets on the same side of the wall. "Through-the-wall" type boxes are not permitted.

F. CASEWORK COORDINATION: Outlets above counters shall be mounted horizontally just above the back splash. Mount horizontally in the backsplash where noted and where above the backsplash would conflict with other trades' equipment such as markerboards and tackboards, refer to architectural drawings and elevations. Outlets below counter shall be mounted in the knee space. Refer to casework drawings. Outlets shown together shall be mounted close together, not on adjacent studs. Provide appropriate mounting hardware to support between studs.

2.5 CONDUCTORS

A. REQUIRED: A complete system of conductors in all raceway systems except where shown otherwise. No conductors are to be installed in telephone conduit. Emergency or exit circuitry shall be installed in a separate raceway system.

B. BUILDING WIRE: 600 Volt, stranded, soft drawn annealed copper, 98% conductivity, continuous from outlet to outlet. Minimum wire size #12 except remote control wire may be #14. All wires shall be color coded with same color connected to same ungrounded phase throughout the installation.

01 All wire shall be type THHN, THW-2 THWN-2 (wet rated for 90° C), or XHHW-2.

a. Exceptions:

1) Where providing connection for circuits containing variable frequency drives (VFDs) wiring shall be type XHHW-2 insulated conductors.

C. BURIED GROUND WIRE: Conductors used to interconnect ground rods of a grounding triad or

supplemental ground loop shall be minimum #2, uninsulated, tinned, stranded copper wire. Connect this wire to rod with short length of same wire, thermo-welded to loop and rod.

D. MANUFACTURERS: Collier, General Cable, General Electric, Simplex, Triangle and Southwire Co.

E. CONNECTORS: Make all connections on #10 and smaller wire with Code approved solderless pressure type insulated connectors; Ideal Wingnut, 3M Spring Connectors, or equal. Solderless lugs must be used for all terminations.

F. TEST: After installation of all conductors, and before final acceptance, make such tests as are required to determine proper functioning of all circuits. Furnish all necessary instruments required to make such tests and correct any deficiencies found.

2.6 CONNECTIONS TO MOTORS, EQUIPMENT AND DEVICES

A. POWER WIRING: Make wiring connections to all mechanical, plumbing and other equipment being installed as a part of this Contract. Where a specific receptacle type is indicated on the drawings provide new or modify existing cord/whip with the matching plug type. Where a general NEMA/IEC/CS receptacle type is indicated on the drawings provide a receptacle matching the provided equipment connection. Confirm connections and equipment requirements prior to rough-in.

01 Make final connections to and provide matching cords/plugs for equipment and devices furnished by others. In particular provide and install all cords, plugs, whips, hardwiring, etc. for shop equipment, welders, cord reels, disposers, ice machines, and similar equipment.

02 Make final connections to and provide matching cords/plugs for Owner furnished equipment and devices. In particular provide and install all cords, plugs, whips, hardwiring, etc. for Owner provided shop equipment, copy machines, system furniture, and similar equipment.

B. CONTROL WIRING: Control and interlock wiring for HVAC Systems will be provided by the Mechanical Contractor. Motorized dampers of the same voltage as the associated fan shall be wired by the electrical contractor when the damper is in close proximity to the fan. Under this section provide a 20 amp, 120 volt circuit to the control panel in each mechanical room from the local low voltage panel.

C. CONNECTIONS TO EQUIPMENT: Make connection to each motor and other equipment subject to vibration with not less than 18" or more than 24” of flexible conduit. All horizontal runs of conduit (not strapped to walls) must be kept above 7 feet high, with a vertical drop to equipment. Conduit blocking walk and service space is not acceptable and will require relocation. Conduit on and adjacent to equipment must be located to allow free access to all removable panels for equipment service. Wire adjacent to heat producing equipment, such as boilers and electric heaters, must be of a type approved for this use.

D. CONNECTIONS TO TRANSFORMERS: Install not less than 18" or more than 24” of flexible conduit at each connection to floor mounted transformers.

E. CONNECTIONS TO RECEPTACLES: Multiple devices on a circuit such as receptacles shall be back wired with pigtail so device does not provide continuity path.

01 Feed through connections for GFCI receptacles to provide protection for downstream receptacles is not allowed.

2.7 CIRCUITRY

A. The intent of the drawings is to indicate schematically the circuitry required.

B. 20 amp, single phase branch circuits serving lighting may be grouped in a single raceway provided a neutral conductor is installed for each circuit requiring a neutral.

C. 20 amp, single phase branch circuits serving receptacles may be grouped in a single raceway provided a neutral conductor is installed for each circuit requiring a neutral.

D. Do not install more than four current carrying conductors in a conduit, except a total of ten #12 or #10 conductors, including grounding conductors, may be installed in 3/4" or larger conduit.

E. NEMA power outlet circuits shall have dedicated raceways.

F. Segregate data processing circuits and stage dimming circuits from other types of circuits.

G. Do not install 480/277 volt conductors in the same conduit with 240/208/120 volt conductors.

H. The work performed in grouping conductors in a single raceway shall comply with all applicable articles in the latest edition of the NEC and Local Codes which shall include, but shall not be limited to, ampacity de-rating of conductors and maximum capacities of raceways.

2.8 POWER CONDUCTOR COLOR CODING

A. 480/277 VOLT SYSTEM: Conductors shall have insulation of the proper color as listed below:

Phase A	- Brown
Phase B	- Purple
Phase C	- Yellow
Neutral	- Natural Gray
Ground	- Green
Isolated Ground	- Green w/ yellow stripe

B. 208Y/120 VOLT SYSTEMS: Conductors shall have insulation of the proper color as listed below:

Phase A	- Black
Phase B	- Red
Phase C	- Blue
Neutral	- White
Ground	- Green
Isolated Ground	- Green w/ yellow stripe

C. 240/120 VOLT DELTA AND SPLIT PHASE SYSTEMS

Phase A	- Black
Phase B	- Orange (high leg of delta)
Phase C	- Blue
Neutral	- White w/ colored stripe
Ground	- Green
Isolated Ground	- Green w/ yellow stripe

D. If the existing facility has a consistent but different color coding, match existing.

E. Contractor may use colored tape marking for size 8 and larger phase and neutral conductors, and size 4 and larger ground conductors.

F. Switch legs are to be color coded the same as the un-switched phase, i.e., all wiring from lighting control panels and contactors shall retain the phase color.

2.9 GROUNDING

A. Reference section 26 05 26 Grounding and Bonding for Electrical Systems.

2.10 SIGNS AND NAMEPLATES

A. Provide all signs/labels as required by local codes and authority having jurisdiction.

B. Provide an engraved nameplate for each panel, switchboard, transformer, disconnect switch, fused switch, and starter stating the name as listed on the drawings (or load serviced), equipment voltage and where its power is derived. Provide short circuit label on all new switchboards and panelboards.

C. Refer to individual equipment specifications for additional labels required.

END OF SECTION 26 05 00

SECTION 26 05 26

GROUNDING AND BONDING;

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

1.2 RELATED WORK

A. Section 26 05 00 – Common Work Results for Electrical

B. Division 27 – Communications Systems

C. Division 28 – Physical Security Systems

1.3 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Ground access wells.

1.4 REFERENCE STANDARDS

A. ANSI/TIA-607-B-2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications

B. ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings

C. IEEE C2-2007 - National Electrical Safely Code

D. IEEE 81 – IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.

E. IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding

F. LPI 175 – Lightning Protection Standards

G. Motorola R56 – Standards and Guidelines for Communication Sites

H. NECA 1 – Standard for Good Workmanship in Electrical Construction; 2015.

I. NEMA GR 1 – Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

J. NETA ATS – Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.

K. NFPA 70 – National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 70E - Standard for Electrical Safely in the Workplace

M. NFPA 780 – Standard for the Installation of Lightning Protection Systems

N. UL 96 – Lightning Protection Components

O. UL 96A – Installation Requirements for Lightning Protection Systems

P. UL 467 – Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.5 GENERAL COORDINATION REQUIREMENTS

A. Drawings and Specifications are intended to be complimentary. Any work described in either of them, will be work required under this contract. Where there is a conflict between the Drawings and Specifications it shall be clarified by RFI. Barring clarification prior to bidding the most expensive option shall be included and clarification shall be made during construction.

B. Reference the Drawings, Floor Plans, Details, and Specifications for additional information. Specific grounding required as noted in the drawings, specifications, and design standards in excess of NEC 250 grounding requirements shall be done. More stringent requirements shall take precedence over NEC 250 listed minimum requirements.

C. Should any work required by the Drawings and Specifications be contrary to the requirements of the applicable codes or standards contractor shall request clarification by RFI before proceeding with the work.

PART 2 - MATERIALS AND METHODS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. GENERAL: Permanently and securely ground the mechanical and plumbing equipment and piping systems, conduit system, panel boards and all other components of the electrical system installed or connected by the Sub-contractor. Follow NEC and building code requirements.

B. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.

C. Do not use products for applications other than as permitted by NFPA 70 and product listing.

D. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

E. Provide a ground conductor in all raceways and cables. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

F. Grounding System Resistance:

01 Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.

02 Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

G. Grounding Electrode System:

01 Provide connection to required and supplemental grounding electrodes indicated to form

grounding electrode system.

a. Provide continuous grounding electrode conductors without splice or joint.

b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.

c. Conduit containing a service or transformer grounding wire shall be grounded at each end to the grounding wire. Use conduit grounding fitting at ground rods.

02 Metal Underground Water Pipe(s):

a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.

b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.

03 Metal In-Ground Support Structure:

a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.

04 Ground Rod Electrode(s):

a. Provide single electrode unless otherwise indicated or required.

1) Where required to meet resistance requirements, space electrodes not less than 10 feet from each other and any other ground electrode.

b. Where electrodes are installed in concrete, building slab, or similar impervious surfaces mechanically secure the electrode with waterproof, non-shrink grout or similar suitable material.

c. Main System Ground:

1) Ground system neutral in service entrance equipment to the building steel and three 3/4" x 10 foot, copper clad, driven ground rods.

2) Install ground rods in a grassy area outside the building in an equilateral triangle pattern, 15 feet on a side, with rod tops 12” below grade.

3) Do not install under the building, concrete or other impermeable surface without prior written approval.

4) Connect ground wire from rod to rod in a complete loop then extend to service equipment.

5) Use cadweld connections below grade.

6) Refer to drawings for additional information.

05 Ufer Ground (Concrete-Encased Grounding Electrode):

a. Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

b. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.

c. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

06 Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

H. Service-Supplied System Grounding:

01 For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.

02 For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

I. Separately Derived System Grounding:

01 Separately derived systems include, but are not limited to:

a. Transformers (except autotransformers such as buck-boost transformers).

b. Uninterruptible power supplies (UPS), when configured as separately derived systems.

c. Generators, when neutral is switched in the transfer switch.

02 Provide locally driven ground rod at each separately derived system.

a. Each transformer shall have its enclosure and secondary neutral terminal (except when a neutral terminal does not exist) bonded to the building steel and local, driven ground rod.

03 Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.

04 Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.

05 Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.

06 Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.

07 Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

J. Bonding and Equipment Grounding:

01 Circuit Grounds:

a. Provide a green ground wire sized per the NEC for every circuit.

b. Provide an additional green w/ yellow strip isolated ground wire for all computer and isolated ground circuits. Refer to drawings.

02 Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

a. Make firm ground to raceway system.

b. Equipment connected with flexible conduit or SealTite shall have the specified ground wire installed inside conduit. Do not install on the outside of the conduit.

c. Where enclosure is painted, remove paint where ground lugs are installed.

03 Provide insulated equipment grounding conductor in each feeder and branch circuit

raceway. Do not use raceways as sole equipment grounding conductor.

04 Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

05 Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

06 Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

07 Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

K. Low Voltage Systems

01 Telephone System Ground: Install a #6 ground wire from the telephone board to ground rod at the telephone board and connect to building service or TMGB/TGB.

02 Sound System Ground: Install a #6 ground wire from the amplifier equipment to the ground bar in the Service Entrance Equipment or TMGB/TGB.

03 Public Address System Ground: Install a #6 ground wire from the amplifier equipment to the ground bar in the Service Entrance Equipment or TMGB/TGB.

04 Data System Grounding Network:

a. Reference Standards and Codes:

1) IEEE C2-2007 - National Electrical Safely Code

2) IEEE Std. 837-2002, or latest version – Standard for Qualifying Permanent Connections Used in Substation Grounding

3) ANSI/TIA-607-B-2011 - Commercial Building Grounding and Bonding Requirements for Telecommunications

4) NFPA 70E - Standard for Electrical Safely in the Workplace

5) ANSI/NECA/BICSI-607 - Telecommunications Bonding and Grounding Planning and Installation methods for Commercial Buildings

6) UL 467 - Standard for Grounding and Bonding Equipment

b. Install copper grounding bar in each data room of sufficient length for all system grounding connections in the space with a minimum length as indicated on the technology drawings. All holes shall be pre-drilled/tapped. Mount on wall with standoff isolators.

c. Extend minimum #3/0 telecommunications bonding backbone (TBB) wire from the MC/MDF ground bar to the service entrance ground bar in the main distribution panel.

d. Provide minimum #3/0 TBB ground wire between data closets per industry standards.

e. Additional bonding requirements:

1) Extend additional bonding wire from data room ground bar to local steel structure. Bonding wire to local steel shall be minimum #3/0 in MC/MDF and minimum #6 in IC/IDF.

2) Extend additional bonding wires to sound equipment, panelboards, A/V systems, etc. as indicated on the drawings.

f. All telecommunications bonding wires shall be installed in raceway and be continuous without splices.

1) Label all pull boxes “TELECOMMUNICATIONS GROUNDING BACKBONE”.

2) Any splice/taps shall require written approval by the Engineer prior to being made.

3) Connections shall be made in an accessible location within telecommunications spaces or j-box with an exothermic weld. Where located above ceiling the connection shall be inside an 8”x8”x6” j-box with cover. Affix a label to the j-box cover and on the ceiling grid below reading “TELECOMMUNICATIONS GROUNDING BACKBONE SPLICE”.

g. Connections to the telecommunications main grounding busbar (TMGB) and telecommunications grounding busbar (TGB) shall be made with 2-hole irreversible compression lugs.

h. Connection from TMGB/TGB to low voltage cabinets/equipment shall be #6 wire by installing contractor.

i. Size all grounding conductors per TIA-607-B.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

01 Provide products listed, classified, and labeled as suitable for the purpose intended.

02 Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 00:

01 Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1) Use bare, tinned, copper conductors where installed underground in direct contact with earth.
2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

01 Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

02 Unless otherwise indicated, use exothermic welded connections for all ground connections.

03 Manufacturers - Mechanical and Compression Connectors:

a. Advanced Lightning Technology (ALT): www.altfab.com

b. Burndy LLC: www.burndy.com

c. Harger Lightning & Grounding: www.harger.com

d. Thomas & Betts Corporation: www.tnb.com

04 Manufacturers - Exothermic Welded Connections:

a. Burndy LLC: www.burndy.com/

b. Cadweld, a brand of Erico International Corporation: www.erico.com

c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com

D. Ground Bars:

01 Description: Copper rectangular ground bars with mounting brackets and insulators.

02 Size:

a. Lengths shall be sized as required for the applicable connections with an additional 25% capacity for future growth. Minimum length shall be 14”.

b. Refer to technology drawings for technology ground bar requirements.

03 Holes for Connections: As indicated or as required for connections to be made.

04 Manufacturers:

a. Advanced Lightning Technology (ALT): www.altfab.com

b. Erico International Corporation: www.erico.com

c. Harger Lightning & Grounding: www.harger.com

d. Hubbell Premise Wiring: www.hubbell.com

e. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com

E. Ground Rod Electrodes:

01 Comply with NEMA GR 1.

02 Material: Copper-bonded (copper-clad) steel.

03 Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.

a. Sectional rods may be used when rods are longer than 10 feet.

F. Ground Access Wells:

01 Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected vehicular load at the installed location.

a. Minimum ANSI TIER 15 where located in driveways, parking lots, or other areas subject to occasional heavy vehicular traffic.

b. ANSI TIER 8 where located adjacent to areas requiring ANSI TIER 15 above.

c. Minimum ANSI TIER 5 at all other locations.

02 Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.

a. Round Wells: Not less than 8 inches in diameter.

03 Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches.

04 Cover: Factory-identified by permanent means with word "GROUND".

05 Manufacturers:

a. Advanced Lightning Technology (ALT): www.altfab.com/

b. Erico International Corporation: www.erico.com/

c. Harger Lightning & Grounding: www.harger.com/

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes:

01 Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

02 Use driving sleeves or couplings when driving ground rods into the earth.

a. Drive exterior rods until tops are at least 2 inches below final grade unless

otherwise indicated. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor. Use driving sleeves or couplings when driving ground rods into the earth.

03 Where the ground is augured to install the ground rod, backfill with Bentonite or similar material.

04 Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated.

05 Make connections without exposing steel or damaging coating if any

D. Make grounding and bonding connections using specified connectors.

01 Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

02 Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

03 Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

04 Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

05 Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 260500.

3.2 TESTING

A. Grounding System Tests:

01 Notify the Owner’s representatives three days prior to scheduled testing dates so they may be present at the time of testing.

02 Perform all ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

03 Prior to beginning work:

a. Perform a “Wenner four-point” soil resistivity test.

04 Certified measurements to be taken and submitted prior to connection to main service utility ground.

a. Upon completion of the ground installation and before connection to the permanent facility power, the electrical contractor shall provide at his expense, a performance measurement of the new earth grounding electrode system. The testing shall utilize either an earth resistance meter and be conducted in accordance with the IEEE Standard 3-point fall of potential method or with a Clamp-on Resistance Test meter.

1) If the 3-Point fall of potential test is utilized, the ground system must be isolated from any utility neutral connections and/or outside ground references prior to testing.

2) If the Clamp-on resistance test is utilized, a single path must exist between the ground system and a utility reference.

b. Ground grid resistance shall not exceed 5 ohms.

1) The grounding system shall pass either a 3-Point Fall of Potential test or the Clamp-on Resistance test. The minimum of 5 times the length of the electrode for a single rod, or 5 times the diagonal of a ground grid (10

times is desired). Contractor shall provide a plot of the curve of resistance vs. distance to the Owner. The conductor shall immediately notify the Owner's representative if the measured resistance is above 5 ohms.

2) The Clamp-on Resistance testing shall be completed utilizing a single ground reference path between the ground system and the reference utility. This will be accomplished either through the ground conductor of a single point ground or by means of a temporary bonding jumper between the installed ground system and a utility reference, prior to any bonding to the system. Should the measurement of the resistance be less than 1 ohm to earth, contact the Owner's representative to verify that the ground system has been designed to achieve 1 ohm. If not, the reading is likely a measurement of continuity and not ground resistance.

c. The manufacturer or an independent testing firm shall be employed for the testing and report. The contractor shall submit a copy of the test report to the Owner's representative within 10 days after testing and before the ground system becomes inaccessible.

d. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

B. Test equipment grounding conductors for continuity and shorts.

C. Test receptacles for ground connections with devices manufactured for that purpose.

D. Investigate and correct deficiencies.

END OF SECTION 26 05 26

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A.

B. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

1.2 REFERENCES

A. IECC – International Energy Code

B. NFPA 70 - National Electrical Code.

1.3 SUMMARY

A. Section includes commissioning process requirements for Electrical and Low Voltage Systems

B. Related Sections:

01 Division 01 Section "General Commissioning Requirements" for general commissioning process requirements.

C. The cost of the Commissioning Authority shall be selected and paid for by the Owner.

1.4 GENERAL REQUIREMENTS

A. Test electrical systems and equipment.

B. These tests are required to determine that the equipment involved may be safely energized and operated.

C. Perform tests by and under the supervision of fully experienced and qualified personnel. Advise each respective manufacturer's representative of tests on their equipment.

D. Record all test data.

E. Each section of Division 26 that has products or systems listed herein incorporate this section by reference and is incomplete without the required tests stated herein.

1.5 DEFINITIONS

A. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

B. CxA: Commissioning Authority

C. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Provide electrical coordination study.

B. Perform commissioning tests at the direction of the CxA.

C. Attend construction phase controls coordination meeting.

D. Provide information requested by the CxA for final commissioning documentation.

E. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data for the complete range of testing for the required test period.

1.7 CxA'S RESPONSIBILITIES

A. Provide project-specific construction checklists and commissioning process test procedures for actual Electrical Systems, assemblies, equipment and components to be furnished and installed as part of the construction contract.

B. Direct commissioning testing.

C. Provide test data, inspection reports, and certificates in Systems Manual.

1.8 SUBMITTALS

A. Submit test report forms for review a minimum of 90 days prior to requesting a final review by A/E.

B. Furnish six individually bound copies of test data. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of test instrument and list all measurements taken, both prior to and after any corrections are made to the system. Record all failures and corrective action taken to remedy incorrect situation.

C. A/E will retain one copy. Remaining copies will be returned to Contractor for inclusion in the operation and maintenance manuals.

PART 2 - MATERIALS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Furnish proposed test procedures, recording forms, list of personnel and test equipment for A/E review.

B. Follow recommended procedures for testing as published by test equipment manufacturer.

3.2 LIGHTING CONTROLS

A. Prior to passing final inspection, the contractor shall perform functional testing in the presence of the registered design professional, the owner and/or their agent. The functional testing shall be as required by section C408.3.1 of the 2015 IECC.

01 The functional testing shall provide evidence that the lighting control systems, including both hardware and software, are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's instructions.

02 The functional testing shall be in accordance with sections c408.3.1.1 and c408.3.1.2 of the 2015 IECC for the applicable control type.

03 A written report shall be generated documenting the functional testing results in accordance with the 2015 IECC requirements.

B. All lighting controls O&M manuals, as-builts, testing reports and documentation related to the lighting control system shall be provided in their final and approved form within 60 days of the certificate of occupancy. All documents certifying that the installed lighting controls meet documented performance criteria of section C405 of the 2015 IECC shall be included in the O&M manuals.

C. All documents from items #1 and #2 above shall be combined and provided to the owner within 90 days from the date of receipt of the certificate of occupancy.

D. Interior & Exterior

01 Occupancy sensors (Offices, storage, staff room, other non-studentareas: 15% sampling

with acceptable pass rate of 90%, continue until pass rate is met. Excess tests required due to failures SHALL NOT be at expense of Owner).

02 Time switch controls

03 Daylight responsive controls

04 Classrooms: 20% sampling with acceptable pass rate of 90%, continue until pass rate is met. Excess tests required due to failures SHALL NOT be at expense of Owner.

05 Other instructional spaces: 20% sampling with acceptable pass rate of 90%, continue until pass rate is met. Excess tests required due to failures SHALL NOT be at expense of Owner.

06 Exterior area, façade, and canopy/soffit lighting.

3.3 EMERGENCY POWER

A. Standby Generator

01 Generator Startup and Building Transfer

02 Generator Exerciser Scheduling

03 Automatic Transfer Switch (ATS) settings, programming, and building transfer.

04 Manual Transfer Switch (MTS) operation.

B. Life Safety Systems:

01 Emergency lighting relay operation.

02 Battery Backup Operation

END OF SECTION 26 08 00

SECTION 26 09 23

LIGHTING CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

1.2 RELATED WORK

A. Section 23 09 23 – Direct Digital Control System for HVAC

B. Section 23 09 93 – Sequence of Operations for HVAC Controls

C. Section 26 27 26 – Wiring Devices

D. Section 26 32 13 – Packaged Generator Assemblies

E. Section 26 36 23 – Automatic Transfer Switch

F. Section 28 13 00 – Security and Access Control System

G. Section 28 31 00 – Fire Detection and Alarm

1.3 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

B. International Electrotechnical Commission (IEC)

C. International Organization for Standardization (ISO)

D. National Electrical Manufacturers Association (NEMA)

E. WD1 (R2005) - General Color Requirements for Wiring Devices.

F. NEMA WD7 -

G. Underwriters Laboratories, Inc. (UL)

01 508 – Industrial Control Equipment

02 924 – Emergency Lighting

1.4 GENERAL REQUIREMENTS

A. 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. Extent of lighting control system work is indicated by drawings and by the requirements of this section.

01 All interior lighting is local control only, no networked systems are allowed.

02 Interior lighting shall include line voltage switching devices, control stations, group switching, and low voltage switching systems with lighting automation relay boxes/power packs & associated low voltage switches.

03 Exterior lighting controls shall be relay based and controlled by the BAS control system using astronomical time clock scheduling. Exterior lighting shall be separated on individual relays based on type and function.

04 Sports lighting controls shall be provided as part of the sports lighting system under 265658 Exterior Athletic Field Lighting.

C. Contractor shall provide all quantities for system including but not limited to relays, relay boxes, relay panels, power packs, switches, switch plates and plate configuration, and wire lengths for both low voltage and line voltage connections.

D. Contractor shall demonstrate the complete successful operation of system including emergency transfer, sports lighting and security/site lighting control a minimum of 30 days prior to contract schedule completion date.

E. Contractor shall provide all quantities for system including but not limited to relays, relay panels, switches, switch plates and plate configuration, wire lengths for both data and switches.

F. A coordination meeting between the General Contractor, Electrical subcontractor, and the Supplier of the Generator and ATS system shall occur prior to formal submittal.

G. Contractor shall demonstrate the complete successful operation of system including emergency transfer and security/site lighting control a minimum of 30 days prior to contract schedule completion date.

H. The lighting controls contractor shall provide the control interface with the common space interior lighting relay panel to tie to the building automation system (BAS). Coordinate with controls contractor for interface type prior to ordering.

I. Interlock lighting control system with other systems as follows:

01 Interlock with fire alarm to enable egress upon activation.

J. Master Override Switches:

01 Shall be momentary rotary key type as specified in 262726 Wiring Devices, no exceptions.

02 Required Zones:

a. Interior Corridors

1.5 INTRODUCTION

A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. 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. Installing electrical contractor shall replace any failed warranty material during warranty period of one year.

1.6 SYSTEM DESCRIPTION

A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. It is defined to include, but not by way of limitation:

01 Room Controller – Turnkey solutions to meet typical applications and provide product necessary to help a space meet the requirements of International Energy Conservation Code (IECC) out of the box. The Room Controller includes all defined equipment to meet the following applications.

02 Room Controllers – Stand-alone three relay controller with 0-10 volt control for ballasts or

LED drivers with integral UL 924 emergency relay (model dependent).

03 Occupancy Sensors – Auto adjusting, MicroSet technology NEMA WD7 compliant occupancy sensors.

04 Wallstations – Smart device that is pre-configured, pre-engraved digital pushbutton wallstations and dimmers. Custom engraving is available upon request.

05 Scene Wallstation – Smart device that is pre-configured, pre-engraved digital pushbutton scene wallstations, dimmers and programmable scene buttons.

06 Daylight Photosensor – Smart device that is a multi-zone open loop daylight sensor with two-way active infrared (IR) communications, which can provide dimming control for daylight harvesting and personal control and programming for the space.

07 Slide Dimmers – Manual on/off button control of lights with slider for adjustable dimming control via 0-10 volt connection.

08 Relay Panels – Centralized control of up to 48 individual 20-amp zones of lighting. Allows for an internal time schedule to be set, or connection to BAS via contact closure input.

09 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.

B. Minimum lighting control performance required, unless local Energy Code is more stringent.

01 Occupancy/vacancy requirements – Provide an occupancy/vacancy sensors with Manual On/ Automatic Off or Automatic On/ Automatic Off functionality in all spaces. Manual On vacancy sensors should be used for any enclosed space with a Manual On switch that does not require hands free operation. Spaces with multiple occupants or where line of sight might be obscured ceiling or corner mount sensors and Manual wallstations would be required. Automatic On of lighting via occupancy sensor cannot exceed 50% of lighting. Systems that do not allow the user to select Occupancy or Vacancy Mode shall not be acceptable.

02 Task Lighting / Receptacle Control (if applicable) – Provide automatic shut off of non-essential plug loads and task lighting in all spaces. Provide Manual On or Automatic On of receptacles whenever spaces are occupied. Receptacle Control will only be shut off when no occupancy is detected within the space. Systems that do not provide receptacle control for a full 20 Amp circuit shall not be acceptable.

03 Daylight Zones – Primary sidelit or toplit areas within an enclosed space shall be controlled separately and automatically by a multi-level photocontrol device without the need for programming. Adjustments to the daylight zones must be provided by a simple to use, intuitive remote handheld device.

04 Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to dim electric light to the lowest light level.

05 Provide the ability to adjust the high end and low end trim of the dimmers to ensure the lighting automatically provides energy saving even when daylighting calls for full illumination.

06 Provide the ability for the dimmers and the relays to function separately. Systems where the 0-10V dimmers and relays are tied together reduce design capabilities and shall not be acceptable.

1.7 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.

D. UL Approvals: Remote panels are to be UL listed under UL 916 Energy Management Equipment.

E. FCC Emissions: All assemblies are to be in compliance with FCC emissions Standards specified in Part 15 Subpart J for Class A application.

F. Manufacturer: Minimum [10] years' experience in manufacture of lighting controls.

G. Products: All electrical components and devices shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency and marked for intended use.

H. Comply with NFPA 70.

1.8 SUBMITTALS

A. Submit manufacturer's data on lighting control system and components including shop drawings, detailed point to point wiring diagrams, and floor plans showing occupancy and daylighting sensor locations. Provide typical mounting details for occupancy and daylighting sensors for this application.

B. Reference 260000 General Electrical Requirements for additional information.

1.9 MANUFACTURERS

A. Provide lighting controls as indicated on the drawings using one of the following lighting control systems or equal with prior approval. This specification basis of design is:

01 Cooper Lighting Solutions (Eaton Greengate) only, no substitutions.

02 Basis of design product: Cooper Lighting Solutions

a. Cooper Lighting Solutions Room Controller

b. Cooper Lighting Solutions Greengate Relay Panels

c. Cooper Lighting Solutions Stand-Alone Control Devices

B. Substitutions or pre-bid submittals may be proposed during the bidding process as outlined in the General Electrical Section.

1.10 DELIVERY, STORAGE AND HANDLING

A. The contractor is responsible for complete installation of the entire system according to strict factory standards and requirements.

B. Packaging: All components of the lighting control system shall be packaged as individual components. Individual component packages will be marked with product catalog number.

C. Handling: Packaging will include clear installation instructions for all components with typical illustrations of installation locations and connections. The installing contractor can easily match each package to the layout on the design floor plans.

1.11 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

B. Ambient temperature: 0° to 40° C (32° to 104° F)

C. Relative humidity: Maximum 90 percent, non-condensing

D. Coordinate layout and installation of luminaries and controls with other construction.

E. Coordinate site commissioning with manufacturer no less than 21 days prior to required date.

PART 2 - MATERIALS

2.1 LIGHTING KEYED SWITCHES

A. Keyed switches shall utilize district standard device and key type as specified and provided under 26 27 26 Wiring Devices and integrated into the lighting controls system.

2.2 SINGLE / DUAL RELAY WALL SWITCH OCCUPANCY SENSORS

A. Type Line Voltage PIR: Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled.

B. Type Line Voltage Ultrasonic or Microphonic: Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled.

C. Type Line Voltage Dual Technology: Dual technology (passive infrared and ultrasonic; passive infrared and microphonic) wall switch occupancy sensor. Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled.

D. Type Low Voltage Dual Technology: Dual technology (passive infrared and ultrasonic; passive infrared and microphonic) wall switch occupancy sensor Furnish the Company's model which suits the electrical system parameters, and accommodates the square-foot coverage and wattage requirement for each area (and type of lighting) controlled.

E. Reference drawings for number, location and switch types.

2.3 WALL OR CEILING MOUNTED OCCUPANCY PERFORMANCE REQUIREMENTS

A. Sensing mechanism:

01 [Infrared]: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.

02 [Ultrasonic]:

a. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.

b. Utilize Doppler shift ultrasonic detection technology.

03 [Dual technology]:

a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.

b. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.

c. Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.

B. Power failure memory:

01 Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.

C. Designed and tested to withstand discharges of 15,000 volts per IEC 801-2 without impairment of performance.

D. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.

E. Sensor shall have time delays from 10 to 30 min.

F. When specified, sensors shall automatically adjust time delay and sensitivity settings.

G. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

H. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

I. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.4 CEILING MOUNTED SENSORS

A. Product: [OAC-DT-2000], [OAC-DT-1000], [OXC-P-2MH0-R]

B. Provide all necessary mounting hardware and instructions.

C. Sensors shall be Class 2 devices.

D. Connect to Room Controller via Click & Go cable to eliminate wiring errors.

01 [OCC-RJ45] Room Controller accessory is used to allow any standard occupancy/vacancy sensor to utilize Click & Go cable connections.

02 Two RJ45 connection ports for connection to Room Controller.

03 Occupancy Sensor and Daylight sensor shall be capable of a daisy chain connection to the Room Controller.

E. Device calibration and features:

01 Sensitivity – 0-100% in 10% increments.

02 Time delay – 1-30, self-adjusts to 10 min based on room occupancy.

03 Test mode – Fifteen second time delay.

04 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.

05 Walk-through mode.

06 Ultrasonic and Dual Technology Sensors utilize two independent sensor detection circuits simultaneously to ensure optimum performance, regardless of location or proximity to walls and structures.

07 Ultrasonic and Dual Technology Sensors utilize Variable Drive Circuitry (VDC) in cases of over saturation from misapplication, which automatically adjusts the volumetric output without reducing detection capability. Systems that reduce detection coverage area shall not be acceptable.

08 Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency, continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.

09 All load parameters including Automatic On/Manual On, blink warning and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.

F. Device Status LEDs including:

01 PIR Detection

02 Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy-chaining them together to

the Room Controller via Click & Go cable. No additional configuration will be required

J. Sensors shall be RoHS compliant.

2.5 WALL/CORNER MOUNTED SENSORS

A. Product: [OAWC-P-120W], [OAWC-DT-120W],

B. Provide all necessary mounting hardware and instructions.

C. Sensors shall be Class 2 devices.

D. Connect to Room Controller via Click & Go cable to eliminate wiring errors.

01 [OCC-RJ45] Room Controller accessory is used to allow any standard occupancy/vacancy sensor to utilize Click & Go cable connections.

02 Two RJ45 connection ports for connection to Room Controller.

03 Occupancy Sensor and Daylight sensor shall be capable of a daisy-chain connection to the Room Controller.

E. Device calibration and features:

01 Sensitivity – 0-100% in 10% increments.

02 Time delay – 1-30, self-adjusts to 10 min. based on room occupancy.

03 Test Mode – Fifteen second time delay.

04 Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.

05 Walk-Through Mode.

06 Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.

07 All load parameters including Automatic On/Manual ON, blink warning, and daylight enable/disable when daylight sensors are pre-defined with the Room Controller local network.

F. Device Status LEDs including:

01 PIR Detection

02 Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy chaining them together to the Room Controller via Click & Go cable. No additional configuration will be required

J. Sensors shall be RoHS compliant.

2.6 ROOM CONTROLLER ZONE WALLSTATIONS

A. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:

01 Removable buttons for field replacement with engraved buttons and/or alternate color buttons [ENGRV-*BTNL-*], [ENGRV-*BTNS-*]. Button replacement may be completed without removing the switch from the wall.

02 Intuitive button labeling to match application and load controls.

03 Pre-defined digital button configurations. Each wallstation is shipped with pre-defined digital button configurations which are automatically sensed by the connected Room Controller and mapped to specific load controls for immediate out of the box functionality.

B. Two RJ-45 ports for connection to the Room Controller local network.

C. Multiple digital wallstations may be installed in a room by simply connecting them to the Room Controller local network. No additional configuration will be required to achieve multi-way switching.

D. Room Controller digital wallstations are delivered with pre-defined functions including, raise, lower, A/V Mode, Quiet Time, manual and scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.

E. Optional custom labeling is available for application or location specific wallstation button labels.

2.7 ROOM CONTROLLER SCENE WALLSTATIONS

A. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:

01 Removable buttons for field replacement with engraved buttons and/or alternate color buttons [ENGRV-*BTNL-*], [ENGRV-*BTNS-*]. Button replacement may be completed without removing the switch from the wall.

02 Intuitive button labeling to match application and load controls.

03 Pre-defined digital button configurations. Each scene wallstation is shipped with a pre-defined digital button configuration which is automatically sensed by the connected Room Controller and mapped to specific load controls for immediate out-of-the-box scene based functionality.

B. Two RJ45 ports for connection to the Room Controller local network.

C. Multiple digital wallstations may be installed in a room by simply connecting them to the Room Controller local network. No additional configuration will be required to achieve multi-way switching.

D. Room Controller Scene Wallstations are delivered with pre-defined scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.

E. Optional custom labeling is available for application or location specific wallstation button labels.

F. Scene wallstations scene control shall be adjustable through a simple interface or handheld control for flexibility of lighting scenes. This personal remote shall allow individual zone control, scene control and scene setting capabilities. [HHPR-RC]

2.8 DAYLIGHTING ADJUSTMENT HANDHELD REMOTE CONTROLS

A. Battery-operated handheld 10 button configuration for remote daylight sensor configuration. Remote controls shall include the following features:

01 Two-way infrared (IR) transceiver for line of sight communication with the Room Controller daylight sensors within up to 30 feet.

02 Red communication LED on the daylight sensor confirms button press.

03 Inactivity timeout to save battery life.

B. Three intuitive daylight sensor range pushbuttons.

C. Intuitive daylight zone adjustment raise/lower pushbuttons.

D. Cooper Lighting Solutions catalog numbers: [HHPRG-RC].

2.9 ROOM CONTROLLERS

A. Room Controllers are fully functional out-of-the-box 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 will be simple to install and will include line voltage wiring space and will not require additional electrical junction boxes. The control units will include the following features:

B. Fully functional room configuration to the most energy-efficient sequence of operation based upon the connected devices in the room.

C. Simple replacement – Using the automatic configuration capabilities, a Room Controller may be replaced with an off-the-shelf unit without requiring any configuration or setup.

D. Quick installation features including:

01 Included line voltage space to simplify wiring and eliminate the need for separate junction boxes.

02 Included emergency voltage space to simplify wiring of emergency luminaire connections.

03 Breakouts or knockouts for direct conduit connection.

04 Line and low voltage sections include conduit connection points. Systems that require special accessories for direct conduit connections may not comply with local building codes and shall not be acceptable.

05 Quick low voltage connections using standard RJ45 QuickConnect cable.

06 120-277 VAC, 50/60 Hz input voltage.

07 Zero cross circuitry for each load.

08 Three relay configuration.

09 Efficient 150 mA switching power supply.

10 Six RJ45 Click & Go local network ports.

11 All models shall be available in either a plastic or metal enclosure for simplified installation in appropriate spaces.

12 All models support local network connections of wallstations, occupancy-based controls and receptacle controls.

E. On/Off/Dimming Room Controllers shall include:

01 Real time current metering (optional).

02 Room Controller metal enclosure options include a “-PL” in the catalog number.

03 Three relay, three 0-10V dimming zone configuration [RC3D, RC3D-PL].

a. All models support local network connections of wallstations, occupancy-based controls and receptacle controls.

b. Up to three 0-10V analog outputs per relay for control of compatible ballasts and LED drivers.

04 Three relay, three 0-10V dimming zone configuration with one emergency UL 924 relay [RC3DE, RC3DE-PL].

a. All models support local network connections of wallstations, occupancy-based controls and receptacle controls.

b. Up to three 0-10V analog outputs per relay for control of compatible ballasts and LED drivers.

2.10 DAYLIGHT PHOTOSENSORS/ IR RECEIVER)

A. Daylight photosensors work with Room Controllers to provide automatic daylight dimming

capabilities for any load type connected to a room controller. Open loop daylight sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Daylight sensors shall be interchangeable without the need for rewiring. Daylight sensors shall be capable of daisy-chaining with occupancy sensors in each room.

B. Digital daylight sensors include the following features:

01 An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve.

02 The daylight sensor has three light level ranges: Low (3-300 lux), High (30-3000 lux), and Direct Sun (300-30000 lux).

03 For dimming daylight harvesting, the daylight sensor shall provide the capability of controlling multiple (up to three) daylight zones immediately upon connection without programming.

04 Optional digital wallstations to allow occupants to reduce lighting level to increase energy savings and lower lighting levels for a selected period of time or cycle of occupancy.

05 Infrared (IR) transceiver for daylight sensor range and daylight zone gain adjustments via handheld remote programmer. [HHPRG-RC]

06 Infrared (IR) receiver for personal control and scene programming via handheld remote programmer. [HHPR-RC]

07 Red configuration LED that blinks to indicate data transmission.

08 Green Mode status LED that blinks to indicate Daylight Commissioning Mode.

09 Green Mode status LED that remains constant ON when daylight range is set to low for available natural light.

10 One RJ45 port for connection to Room Controller local network.

11 An adjustable head and an optional mounting bracket to accommodate multiple mounting methods and building materials. The daylight sensor may be mounted on a ceiling tile, skylight well, suspended lighting fixture or backbox.

C. Open loop digital daylight sensor includes the following additional features:

01 An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.

02 Automatically establishes dimming set-points upon power up without any programming. Optional calibration using the wireless IR handheld programmer. [HHPRG-RC]

03 Cooper Lighting Solutions Catalog Number: [DSRC-FMOIR].

2.11 OCCUPANCY WALL SWITCHES

A. Product: [ONW-D-1001-MV-*], [ONW-D-1001-DMV-*],

B. [Provide vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0 mm thickness.]

C. [Provide a recessed bypass manual "override on" key on each sensor.]

D. Provide a mechanical air-gap on/off function for all sensors.

E. Capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet

F. Shall accommodate loads from 0-800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have 180 degree coverage capability.

G. Shall be able to have their visible plastic parts replaced, for color changes in the field, without removing the body of the control from the wall and without requiring special tools.

H. Shall utilize Zero Crossing Circuitry which increases relay life, protects from the effects of inrush

current, and increases sensor's longevity.

I. Shall have no leakage current to load, in manual or in Auto/Off Mode for safety purposes and shall have voltage drop protection.

J. Where specified, wall switch sensors shall provide a field selectable option to convert sensor operation from Automatic On to Manual On.

K. Where specified, sensors shall offer daylighting footcandle adjustment control and be able to accommodate dual level lighting.

L. Where specified, dual relay sensors shall offer daylighting footcandle adjustment control for either or both relays.

M. Where specified, dual relay sensors shall offer a Bathroom Mode which keeps the second relay On for an addition 8 minutes after the first relay has been turned off.

N. Where specified, sensors shall feature a universally recognized light bulb icon for end user ease of identification of use.

O. Where specified, dual relay sensors shall feature universally recognized light bulb and fan icons for end user ease of identification of use.

P. Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].

Q. Sensors shall be RoHS compliant.

R. Where specified, sensors shall have an EcoMeter that provides a visual indicator of energy usage, increasing end user awareness and reminding individuals to take control of their lighting to maximize energy savings.

S. Where specified, low voltage sensors shall have a Tracking/HVAC Mode that allows the load connected to the Form C BAS relay to remain on when the lights are turned off manually.

T. Where specified, sensors shall have a tamper-proof Automatic Only Mode that automatically turns lighting on and off without requiring a user to push a button.

2.12 SENSOR SWITCHPACKS

A. Product: [SP20-RD4],

B. Plenum rated

C. Control wiring between sensors and control units shall be Class 2, 18-24 AWG, stranded U.L. Classified, [PVC insulated] [TEFLON jacketed cable suitable for use in plenums].

D. Integrated, self-contained unit consisting internally of an isolated load switching control relay [and a power supply to provide low voltage power].

E. Shall be compatible with incandescent, magnetic or electronic low voltage, and magnetic or electronic fluorescent, as well as motor loads.

F. Shall be capable of controlling receptacle or plug loads

2.13 SLIDE DIMMERS

A. Designed specifically for use with LED fixtures using 0-10v drivers.

B. Can be used in conjunction with an SP20-RD4 switchpack in a low voltage capacity, or as a line voltage switch rated for 120V/277V.

C. 50mAmps maximum sink current.

D. Compatible with Decora Plus standard designer wallplates (sold separately).

2.14 EMERGENCY LIGHTING

A. Room Controller with emergency relay – The Room Controller is a UL 924 listed device that monitors normal power circuit to the Room Controller. The Room Controller has a dedicated UL 924 output which includes emergency power line in and emergency power load out connections. The UL 924 relay will track with output 1 (Yellow) during normal power operations. Upon loss of normal power the UL 924 output will force the emergency lighting On and full bright (if dimming) until normal power is restored. Features include:

01 120-277VAC, 50/60 Hz, 3 amp ballast rating.

02 Laddarless testing: Push the “All Off” button on any wallstation four times [e-mer-gen-cy], will turn off normal lighting and force UL 924 emergency output On and full bright.

03 Auxiliary input for remote Alert Mode (All On, and full bright).

04 Cooper Lighting Solutions Catalog Number: [RC3DE], [RC3DE-PL].

B. Emergency Power Control – A UL 924 listed device installs down-line of an output that monitors a switched or dimmed circuit providing normal lighting to an area. The unit provides normal ON/OFF or 0-10V dimming control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:

01 120-277 volts, 50/60 Hz., 20 amp ballast rating.

02 Push to test button.

03 Cooper Lighting Solutions Catalog Numbers:

a. [CEPC-2] (switching)

b. [CEPC-2-D] (0-10V dimming)

2.15 LIGHTING CONTROL PANELS

A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. Each panel shall be of modular construction and consist of the components listed

B. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1-8 relays, 1-24 relays, or 1-48 relays.

C. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.

D. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:

01 Removable, plug-in terminal blocks with screwless connections for all low voltage terminations.

02 Individual terminal block, override pushbutton, and LED status light for each relay.

03 Direct wired switch inputs associated with each relay and group channel shall support two-wire, momentary or maintained contact switches.

04 Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches, digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs, digital IO modules capable of receiving momentary or maintained contact closure inputs, digital photocell modules, and digital occupancy sensors.

05 True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.

06 Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.

07 Group, channel, and pattern control of relays shall be provided through a simple keypad interface. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override pushbuttons and LED displays.

08 Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:

a. Electrical:

1) 30-amp ballast at 277V

2) 20-amp ballast at 347V

3) 20-amp tungsten at 120V

4) 30 amps resistive at 347V

5) 1.5 HP motor at 120V

6) 14,000-amp short circuit current rating (SCCR) at 347V

7) Relays shall be specifically UL listed for control of plug loads

b. Mechanical:

1) Individually replaceable, ½" KO mounting with removable Class 2 wire harness.

2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.

3) Dual line and load terminals each support two #14 □ #12 solid or stranded conductors.

4) Tested to 300,000 mechanical on/off cycles.

c. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.

E. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.

F. Lighting control panels shall be Cooper Lighting Solutions Greengate Relay Panels with quantity of relays and spares as shown on the plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Contractor shall provide to the manufacturer all quantities for system including but not limited to relays, room controllers, relay panels, plug load controllers, switches, sensors and wire lengths and configurations for both network and device cable at least 1 week before bid.

B. When using wire for connections other than the local low voltage network (Cat 5e with RJ-45 connectors), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements

C. Electrical contractor shall be responsible for scheduling the following onsite coordination meetings through the duration of the project. Attendance shall be required for the GC, EC, representative from MEP firm, BAS Integrator and lighting control rep.

01 Pre-Installation- After submittals have been approved and material has arrived onsite and before installation of any devices begins. Review lighting control layout plans, required as-built information and system connections.

02 Pre-Factory startup- Electrical contractor must have all lighting control devices installed, wired and tested at least 30 days prior to substantial completion deadline. At this coordination meeting the electrical contractor shall walk the site with attendees and go room by room to ensure they are ready for factory technician to start the system programming. Electrical contractor shall have his as built documentation of the system completed for this meeting.

03 Move in: 30 days prior to owner move in all parties shall meet onsite to review completed system. At this time all installation and factory programming shall be completed.

D. The installing electrical contractor shall complete, prior to request of factory start up and site commissioning, complete installation of all relay panels, room controllers, power packs, their respective loads landed and confirmed operations, switches installed, and confirmed operational, and the entire data network shall be pulled from all panels to the designated IT room as indicated on plans.

E. The installing contractor shall, prior to request of factory start up and site commissioning, request a site visit by the local authorized factory rep to assist in identification of any open ended issues, thereby eliminating potential for delays and system commission interruptions. The pre commissioning meeting shall include the Engineer, the Architect, the local rep, the Owner's project manager, the Owner's energy manager, the electrical contractor and the general contractor

01 The control system shall be installed and fully wired as shown on the plans by the installing contractor. The contractor shall complete all electrical connections to all control circuits.

02 All low voltage smart devices shall connect using QuickConnect wire provided by Cooper Lighting Solutions. When using wire for connections other than the QuickConnect low voltage wire (pre-defined lengths of RJ45 cable), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contractor termination requirements.

03 Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

F. Upon confirmation of progress by local factory authorities, the installing electrical contractor will complete the factory startup request form, including any relay/circuit, and switching changes from the contract documents. This is essential to facilitate substantial completion.

G. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

01 Sensor parameters, time delays, sensitivities and daylighting setpoints.

02 Sequence of operation, (e.g. manual ON, Auto OFF. etc.).

03 Load parameters (e.g. blink warning, etc.).

H. Labels:

01 The installing electrical contractor shall clearly label all low voltage wiring inside the relay controllers. Labels shall be typed and indicate what they are connected to (switch, occupancy sensor, etc...) and what room they are connected to. Labels shall be Panduit Permanent Labels or Brother Cable Labels. The room # shall include both the architectural plan room numbers as well as the room numbers to be shown on the signage.

02 The installing electrical contractor shall clearly label all network lighting relay controllers, segment managers and network bridges with line voltage circuits. Labels shall be typed and indicate what panel, voltage and circuit they are connected to. Labels shall be Panduit Permanent Labels or Brother Cable Labels.

03 Relay Panel and Enclosure Field Nameplates: Provide lamacoid nameplate with 5/16" letters on front face showing panel name, voltages contained and circuits numbers. Attach with mastic and two screws. Coordinate to give same name as shown on panelboard schedule.

Relay Panel RA

277V

HA-1,3,5,6,9

I. All low voltage wiring inside the relay controllers must be clean and organized. Wire nuts are not acceptable, only compression fittings.

J. Low voltage wire shall be terminated so the wire jackets match the color coding on the termination blocks.

3.2 SPARE PARTS AND ATTIC STOCK:

A. Provide the following spare devices for each site:

01 Reference 260010 Closeout Requirements.

B. Electrical contractor shall include in his bid the cost to provide and install the additional spare parts and associated wiring as directed by the Owner/engineer. All devices not used during construction shall be turned over to the Owner at the time of job completion.

C. Unused items shall be turned over to the owner within thirty (30) days of substantial completion of the project. Unused material is to be ordered separately when commissioning is scheduled in order to ensure the longest warranty period possible.

3.3 SUPPORT SERVICES

A. Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

B. System Start Up and Commissioning

01 Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:

a. That all occupancy and daylighting sensors are located, installed, and adjusted as intended by the factory and the contract documents.

b. The occupancy sensors and daylighting sensors are operating within the manufacturers specifications.

c. The sensors and room controllers interact as a complete and operational system to meet the design intent.

02 Manufacturer to provide a written statement verifying that the system meets the above requirements.

03 The electrical contractor shall request factory commissioning by submitting a startup request form at least (2) weeks before startup is required.

04 Electrical contractor must schedule lighting control factory start-up to begin at least four (4) weeks prior to substantial completion deadline.

05 Lighting control technician shall issue daily reports notifying of the project status, open issues, challenges, etc. at the end of each day he/she is onsite commissioning the system. Reports shall be sent directly to EC, GC and Architect/Engineer.

06 At the completion of the first visit of the lighting control technician, all parties shall meet onsite to walk the project and evaluate any open issues. At this meeting the schedule for owner training shall be determined.

07 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.

C. System Training

01 Manufacturer shall provide factory authorized technician to train owner personnel in the

operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.

a. Reference 260010 Closeout Requirements.

02 Owner operation memo- Lighting control manufacturer shall prepare an operational memo for owner to distribute informing building occupants of the operation of their lighting control system. Memo shall explain the following but not limited to:

a. auto on/ vs manual on

b. occupancy sensors

c. daylight harvesting

d. plug load control

e. after hours time delays

f. additional systems operations components based on the system design

D. System Programming

01 Manufacturer shall provide system programming including:

a. Wiring documentation.

b. Switch operation.

c. Occupancy sensors.

d. Photocells

02 Verification of a complete and working system

03 Provide computer generated documentation on the commissioning of the system including a room by room description of:

a. Sensor Parameters, time delays, sensitivities and daylighting set points.

b. Sequence of operation (e.g. manual on, auto off, etc.)

c. Load Parameters (e.g. blink warning, etc.)

E. Closeout Documentation

01 Reference 260010 Closeout Requirements.

F. Re-Commissioning

01 Reference 260010 Closeout Requirements.

G. Warranty

01 Reference 260010 Closeout Requirements.

END OF SECTION 26 09 23

SECTION 26 22 13

LOW VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

PART 2 - MATERIALS

2.1 STANDARD DRY TYPE TRANSFORMERS

A. GENERAL: Provide U. L. labeled, plated copper or aluminum wound, two winding type units, NEMA 3R construction suitable for location installed. Provide NEMA 3R construction for all transformers installed under piping. Refer to Drawings for ratings. All products shall be manufactured in North America and shall meet or exceed latest DOE standards.

B. TEMPERATURE RISE: Design shall use 220° C insulation and operate with a maximum temperature rise of 150° C above a 40° C ambient.

C. TAPS: High voltage windings shall be provided with two 2½% taps FCAN and four 2½% taps FCBN.

D. NOISE: The manufacturer shall properly isolate the core and coil from the enclosure with vibration isolation pads in order to minimize the transmission of vibration and noise. Noise levels shall not be more than NEMA and ANSI Standards.

01 Provide extra low noise option for sensitive environments with minimum 5dB reduction in sound levels for transformers located in or immediately adjacent to:

a. Recording studios

b. Performance spaces

c. Meeting rooms

d. Conference rooms

e. Offices

f. Classrooms

g. Dormitories

h. And other areas of similar nature.

E. MANUFACTURERS: GE Industrial (ABB), Siemens, and Square D

2.2 ADJUSTABLE BREAKERS

A. LARGE TRANSFORMERS: Provide adjustable type breakers for overcurrent protection of all low voltage transformers 112.5kVA and larger.

B. COORDINATION STUDY: Provide an electrical coordination study to determine settings of adjustable circuit breakers to match equipment served. Include revised setting of adjustable circuit breakers during the warranty period required to eliminate nuisance tripping. Provide copy of the coordination study with closeout documents.

END OF SECTION 26 22 13

SECTION 26 24 00

PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26 apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

1.2 ABBREVIATIONS

A.	TVSS	Transient Voltage and Surge Suppressor
B.	SPD	Surge Protection Devices
C.	EGF	Equipment Ground Fault, 30mA equipment protection.
D.	GFI or GFCI	Ground Fault Circuit Interruption, 5mA personnel protection.

PART 2 - MATERIALS AND METHODS

2.1 DISTRIBUTION PANELS

A. GENERAL: Provide for panels 600 amps and larger or where indicated on the drawings. Construction in accordance with NEMA standards. Panels and circuit breakers shall be listed for use with 75° C wiring.

B. CABINETS: Panelboard assembly shall be safety dead front type, enclosed in a code gauge steel cabinet with removable end walls. Fronts shall be of code gauge, full-finished steel with rust-inhibiting primer and baked enamel finish. Provide locking door with front hinged trim to box with full length piano hinge and quarter turn fasteners, unless panel is located in a mechanical room. Provide the largest cabinet available for the ampacity panel schedules.

C. BUSSING: Buss structure and main lugs shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or buss bar not to exceed 50° C rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters' Laboratories Standard UL 67. Busses shall be tin silver plated copper braced for the scheduled fault current (50,000 amperes minimum). Provide copper ground and neutral bars including 200% neutral and isolated ground kits as indicated on the drawings Bussing shall accept the largest circuit breaker available for the ampacity scheduled even though only smaller size CB's are listed. Where space only is shown, bussing shall allow any combination of 1, 2 and 3 pole circuit breakers of various frame sizes.

D. CIRCUIT BREAKERS: Circuit breakers shall bolt in or have Square D I-Line plug on construction. Circuit breakers shall be equipped with individually insulated, braced and protected connectors. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF. Trip ratings of the circuit breaker shall be as shown on the panelboard schedule. All spaces shown shall include all buss connectors and any other provisions necessary for future breaker

additions. Minimum 18,000 amperes interrupting capacity for circuit breakers 100A and larger.

E. ARC ENERGY REDUCTION EQUIPMENT: Provide an energy-reducing maintenance (RELT) switch with local status indicator with all switchgear containing circuit breakers rated for or where the highest continuous current trip setting can be adjusted to 1200A or higher per NEC requirements. All documentation on the design, installation and operation of the RELT switch shall be included in O&M documentation.

F. SURGE SUPPRESSION: Panels noted to have SPD surge suppression shall include SPD mounted inside panel. See SPD section within this specification for more information.

G. NAMEPLATES

01 Factory Nameplate: Provide information per industry standards but shall include voltage, phase, buss amperage and short circuit rating.

02 Field Nameplate: Provide lamacoid nameplate with 5/16" letters on front face showing panel name and amperage rating. Attach with mastic and two screws. Coordinate to give same name as shown on panelboard schedule. If used as main service panel provide short circuit available and rating information.

Panel DA 800A MCB
480Y/277V, 3ϕ, 4W
Fed from Switchboard MSB

03 Circuit Nameplate: For each circuit provide a lamacoid nameplate indicating load served and circuit breaker size. For spaces indicate maximum size circuit breaker that can be installed. Examples:

Panel HA 225A/3P

SPARE 400A/3P

400A/3P Space

04 Short Circuit Nameplate: A permanently affixed label shall be attached to all new electrical equipment with the available fault current at the time of installation and calculation. The label shall be minimum 2” x 3” in size and shall be blue lettering on a contrasting background. The label shall also include the date of the calculation. Refer to drawings and equipment short circuit analysis table.

05 Identification of ungrounded conductors: Provide permanent label indicating the color coding of phase conductors based on voltage as noted in 260500 COMMON WORK RESULTS FOR ELECTRICAL.

H. ACCEPTABLE MANUFACTURERS: GE Industrial (ABB), Siemens and Square D.

2.2 BRANCH CIRCUIT PANELBOARDS

A. GENERAL: Provide for panels 400 amps and smaller. Circuit breaker type; Square D Type NQOD for 120/208-240 Volts, NF for 277/480 Volts. Construction shall comply with NEMA and U. L. Standards. Panels and circuit breakers shall be listed for use with 75° C wiring. Mount panel with top of can at 72" above finished floor.

B. CABINETS:

01 Typical Electrical Panels: Safety dead front type with front hinged trim to box with full length piano hinge and quarter turn fasteners; box made of code gage galvanized steel; provide wire bending space per NEC Table 373-6; door-in-door construction with both inner door and outer door with flush type lock and latch, all keyed alike.

02 Panels located in kitchens and concessions areas: Safety dead front type with stainless steel front trim and quarter turn fasteners; box made of code gage galvanized steel; provide wire bending space per NEC Table 373-6; single door construction with flush type lock and latch.

03 All panelboards with 60 or more circuits in a single section shall be 30” wide with extra wire bending space.

C. CIRCUIT BREAKERS: Plug in or bolt in for 120/208-240 Volts, bolt in only for 277/480 Volts; quick make, quick break, trip free, thermal magnetic trip; automatic tripping indicated by handle at midpoint position; multi-pole breakers to have common trip (handle ties are not acceptable). Minimum interrupting ratings shall be 14,000 Amps symmetrical at 277/480 Volts and 10,000 Amps symmetrical at 120/208-240 Volts. All main circuit breakers shall be rated 22,000 Amps minimum and be vertically mounted. Ratings as scheduled on drawings. Square D I-line construction with plug on breakers is acceptable for 277/480 Volts. Install circuit breakers in same order as shown on the drawings. Where spaces are noted, provide buss connectors and all other provisions necessary to add future breakers of any size and number of poles up to 100 amps and three poles.

D. BUSSING: Tin plated copper sized in accordance with NEMA temperature rise standards and installed completely throughout panel for installation of future breakers where schedule shows space only. Provide copper ground and neutral bars including 200% neutral and isolated ground kits as indicated on the drawings. Lugs U. L. rated for Cu/Al terminations. Unless indicated otherwise on drawings, buss bracing shall be 22,000 Amps symmetrical. Panels with 24 or more circuits shall have a minimum of 225 Amp bussing. Provide a ground bar in the Service Entrance Equipment and in each electrical panel having a branch circuit ground wire.

E. SURGE SUPPRESSION: Panels noted to have integral SPD surge suppression shall include SPD mounted inside panel. See SPD section within this specification for more information. The surge suppress device shall not use any of the scheduled spaces. Provide additional bussing and larger can to accommodate the surge suppression device.

F. DIRECTORY: Complete at end of job, typewritten, stating equipment or rooms served by circuit. Type even circuits on right side of card, odd on left side. Provide laminated directory for exterior or wet locations.

G. FINISH: Gray enamel over rust inhibiting treatment after fabrication and before assembly. After installation, and before acceptance by the Owner, assembly shall be painted with a rust inhibiting paint (color selected by Architect). Recessed cans may have galvanized finish.

H. NAMEPLATES

01 Factory Nameplate: Provide information per industry standards but shall include voltage, phase, buss amperage and short circuit rating.

02 Circuit Number Labels: All circuits and spaces shall be clearly labeled on the panel dead front with the typed circuit number labeling provided by the switchgear manufacturer. Circuit numbers shall be attached adjacent to each circuit breaker and space on the panel, even circuits on right side, odd on left.

03 Field Nameplate: Provide lamacoid nameplate with 5/16" letters on front face showing panel name, voltage and amperage rating. Attach with mastic and two screws. Coordinate to give same name as shown on panelboard schedule.

Panel HA 225 MCB

480Y/277V, 3ϕ, 4W

Fed from Panel DA

04 Short Circuit Nameplate: A permanently affixed label shall be attached to all new electrical equipment with the available fault current at the time of installation and calculation. The label shall be minimum 2” x 3” in size and shall be blue lettering on a contrasting background. The label shall also include the date of the calculation. Refer to drawings and equipment short circuit analysis table.

05 Identification of ungrounded conductors: Provide permanent label indicating the color coding of phase conductors based on voltage as noted in 260500 COMMON WORK RESULTS FOR ELECTRICAL.

I. ACCEPTABLE MANUFACTURERS: GE Industrial (ABB), Siemens and Square D.

2.3 INTERNAL TRANSIENT VOLTAGE SURGE SUPPRESSOR (TVSS/SPD)

A. GENERAL: Provide integral SPD equipment for electrical panels and equipment as noted on the Drawings. Some equipment may be noted to have SPD external to the panel or switchboard.

B. INSTALLATION: Integral SPD shall be installed and mounted within the equipment to be protected. Provide a three pole circuit breaker in the panel or direct bus connection. Connect SPD with wiring as short and straight as possible.

C. DISPLAY: Provide LED status indicators and digital transient counter with battery backup.

D. ALARM: Provide audible alarm with silence and test function.

E. SUPPRESSION MODES: System shall provide suppression of L-L, L-N, L-G and N-G transients.

F. RESPONSE TIME: 1 nanosecond or less.

G. EMI/RFI ATTENUATION: 38 dB or better.

H. MONITORING: Provide remote monitoring contacts, dry, 1 form C type, rated for 120V, 1A (30A VDC, 2A).

I. WARRANTY: 10 year, non-prorated replacement.

J. MINIMUM SPD RATING:

01	Panels smaller than 400 amps:	100 kAmps per phase
02	Panels 400 amps up to 800 amps:	150 kAmps per phase
03	Panels 801 amps up to 2000 amps:	240 kAmps per phase
04	Panels greater than 2000A:	400 kAmps per phase

05 Reference drawings for scheduled SPD ratings which may exceed the minimum values indicated here.

K. ACCEPTABLE MANUFACTURERS: GE Industrial (ABB), Siemens, and Square D matching equipment manufacturer.

2.4 ADJUSTABLE CIRCUIT BREAKERS

A. COORDINATION STUDY: Provide an electrical coordination study to determine settings of all adjustable circuit breakers to match equipment served. Include revised setting of adjustable circuit breakers during the warranty period required to eliminate nuisance tripping. Provide copy of the coordination study with closeout documents.

B. LARGE TRANSFORMERS: Provide adjustable type breakers for overcurrent protection of all low voltage transformers 112.5kVA and larger.

C. LARGE MOTORS AND EQUIPMENT: Circuit breakers serving 50 hp and larger motors, or large equipment such as chillers shall be adjustable type coordinated with the starting requirements of the equipment.

2.5 SPECIAL EQUIPMENT LABELING AND DEVICES

A. FIRE ALARM SYSTEM:

01 Provide red circuit lockout device on all circuit breakers serving fire alarm equipment and devices. Coordinate with fire alarm contractor for any circuits added per their design for power supplies, amplifiers, etc.

02 Provide typewritten label with white letters on a contrasting red background reading “FA” permanently attached to the panel dead front adjacent to each breaker.

03 Provide typewritten label with white letters on a contrasting red background permanently attached to the outside of the panel cover reading ‘FIRE ALARM CIRCUIT INSIDE” or similar.

04 Space Age Electronics ELOCK-FA E-Series Lockout Kit or equal. Confirm kit is compatible with provided switchgear prior to ordering.

B. BUILDING AUTOMATION SYSTEM (BAS):

01 Provide blue circuit lockout device on all circuit breakers serving BAS equipment and

devices.

02 Provide typewritten label with white letters on a contrasting blue background reading “BAS” permanently attached to the panel dead front adjacent to each breaker.

a. Where each BAS panel is named the label shall include the panel name. For example “BAS 2-A” for panel 2-A. Panel names shall match as-built conditions.

03 Garvin UBL1-BLU Blue Universal Breaker Lock Out Device or equal. Confirm devices are compatible with provided switchgear prior to ordering.

C. BUILDING NETWORK EQUIPMENT:

01 Provide typewritten label with white letters on a contrasting blue background reading “DATA” permanently attached to the panel dead front adjacent to each breaker.

D. INSTALLATION: Install lockout devices and labels at the end of the job, prior to substantial completion. Labels shall be installed on the opposite side from the switchgear manufacturer’s circuit number labels and square to the housing.

2.6 COORDINATION STUDY

A. Provide a complete electrical coordination study of the electrical distribution system.

01 Short circuit values shall use the ultimate available short circuit current values as identified by the power company.

02 Arc fault study shall use the initial/current power company service values.

03 Provide short circuit and arc fault labels on all new electrical equipment.

B. BREAKER SELECTIONS:

01 Use the study results to determine settings of adjustable circuit breakers and selections/ratings of non-adjustable circuit breakers or fuses so the entire system is coordinate including downstream circuit breakers in other equipment. Include revised setting of adjustable circuit breakers during the warranty period required to eliminate nuisance tripping.

02 Include all systems such as generators, automatic transfer switches, relay panels, etc. in the coordination study and OCP selection process.

C. Provide copy of the coordination study with closeout documents.

D. Provide letter with closeout documents from the manufacturer/certified installer verifying that all breakers have been set complying with the approved coordination study.

END OF SECTION 26 24 00

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

PART 2 - MATERIALS AND METHODS

2.1 WIRING DEVICES

A. GENERAL: All devices must be suitable for use intended, and have voltage and current ratings adequate for loads served. All devices shall have terminals designed for use with stranded wire. All receptacles shall have a grounded pole and green painted, hexagonal, grounding screw. Grounded receptacles shall ground lug internally connected to mounting tabs. Wall outlets shall be installed with the ground pin down. Devices installed in or served through fire rated structures shall be fireproofed in a manner compatible with the U. L. fire rating.

01 ACCEPTABLE MANUFACTURERS: Catalog numbers listed below are Hubbell or Legrand (Pass & Seymour), unless indicated otherwise. Each type of wiring device and associated wall plate shall be from a single manufacturer.

a. Equivalent items made by the below manufacturers will be acceptable provided they meet specification requirements.

1) Hubbell

2) Legrand/Pass & Seymour

3) Leviton

4) Lightolier (dimming only)

5) Lutron (dimming only)

02 DEVICE COLORS:

a. Typical devices shall be white color unless noted otherwise.

1) Devices on standby generator power shall be red color.

2) Device colors to be confirmed with Owner/Architect during submittal period.

b. Typical device faceplates shall be stainless steel unless noted otherwise.

03 WIRING TYPES:

a. Side wire or plug tail devices.

b. Backstab devices are NOT acceptable.

04 COORDINATION:

a. Receptacles for Owner-Furnished Equipment: Match plug configurations.

b. Cord and Plug Sets: Match equipment requirements.

05 LABELING:

a. Provide printed, clear, adhesive label, with one (1) inch, BLACK text identifying panel and circuit on each device face plate.

b. Label shall be in LA-XX format where LA is the panel name and XX is the circuit number.

B. WALL TOGGLE SWITCHES: (20 Amp/277 Volt)

01 Industrial Extra Heavy Duty: Hubbell HBL1221, Legrand PS20AC1, Leviton 1221 or matching 2-pole, 3-way and 4-way switches.

C. MOMENTARY LOW VOLTAGE KEYED SWITCHES:

01 Class 2 low voltage rotary key switch.

02 Switch shall be three position, two circuit, momentary contact, type switch with center position off.

03 Captive key assemblies shall not be acceptable.

04 Lighting controls contractor shall coordinate with electrician to integrate keyed override switches into the lighting controls system. Position 1 (CW) shall be on and Position 3 (CCW) shall be off. Key may be removed from the switch only in the center position.

05 Hubbell LVSKEY-3M-SS with #126 key only, no exceptions.

D. SWITCH WITH LIGHT: (20 Amp/277 Volt, Clear) Hubbell HBL1221ILC

E. MOTOR RATED SWITCH:

01 (20 amp, 277V) P&S PS20AC1

02 (20 amp, 120/277V, Double Pole) P&S PS20AC2 or Hubbell HBL7832D.

03 (30 Amp, 120/277V, Double Pole) P&S PS30AC2 or Hubbell HBL7832D.

04 (30 Amp, 120/277V, Three Pole) Hubbell HBL7810D.

05 All switches shall have minimum rating of upstream overcurrent protection.

06 Where switches are used as disconnecting means the switch shall be lockable in accordance with NEC (2020) 110.25. Provide integral locking tabs on enclosure or lockable switch bracket mounted to the device plate. P&S 7801-P or equal.

F. MOTOR RATED SWITCH WITH PILOT LIGHT:

01 (20 amp, 277V, Red) Hubbell HBL1221PL, P&S PS20AC1-RPL7, Leviton 1221-7PR or matching 3-way switch.

02 (20 amp, 120/277V, Double Pole, Red) Hubbell HBL1222PL, P&S PS20AC2-RPL, Leviton 1222-7PR

03 (30 Amp, 120V, Single, Red) Hubbell HBL3031PL, P&S PS30AC1-RPL, Leviton 3031-PLR or matching 3-way switch.

04 (30 Amp, 277V, Single, Red) Hubbell HBL3031PL

05 (30 Amp, 120/277V, Double Pole, Red) Hubbell HBL3032PL, P&S PS30AC2-RPL

06 All switches shall have minimum rating of upstream overcurrent protection.

07 Where switches are used as disconnecting means the switch shall be lockable in accordance with NEC (2020) 110.25. Provide integral locking tabs on enclosure or lockable switch bracket mounted to the device plate. P&S 7801-P or equal.

G. MANUAL MOTOR STARTER WITH THERMAL OVERLOAD AND PILOT LIGHT.

01 All switches shall have minimum rating of upstream overcurrent protection.

02 All switches shall have red pilot light integral to the switch cover.

03 All switches shall have an integral thermal overload unit to protect downstream devices. Coordinate thermal overload unit with device to be protected.

04 Where switches are used as disconnecting means the switch shall be lockable in accordance with NEC (2020) 110.25. Provide integral locking tabs on enclosure or lockable switch bracket mounted to the device plate. P&S 7801-P or equal.

05 Acceptable manufacturers: Square D FG Series or equal by GE Industrial (ABB), Siemens, or Eaton.

H. CONVENIENCE OUTLETS: (20 amp/125v/3 wire)

01 Industrial, Extra Heavy-Duty, Tamper-Resistant: Hubbell HBL5362TR, Legrand TR5362, Leviton 5362-SG.

02 All outlets in kitchens, concession stands and similar spaces must be tamper resistant and weather resistant: Hubbell BR20WRTRx, Legrand WR20TRx or approved equal.

I. GFCI OUTLET: (20 amp/125v/3 wire) (Extra Heavy-Duty, Tamper-Resistant, LED Indicators, Auto Self-Test).

01 Industrial, Extra Heavy-Duty, Tamper-Resistant: Hubbell GFSG5362X, Legrand 2097TR-X, Leviton G5362-0TX

02 GFI outlets in the kitchen, concessions stand, or similar spaces shall be Industrial, Extra Heavy-Duty, Tamper-Resistant, Weather Resistant: Hubbell GFSG5362X, P&S 2097TRWR-X or Leviton G5362-WTX.

03 GFI outlets at the exterior of the building or damp/wet locations shall be Industrial, Extra Heavy-Duty, Tamper-Resistant, Weather Resistant: Hubbell GFSG5362X, Legrand 2097TRWR-X, Leviton G5362-WTX.

04 Provide standard receptacle with remote dead front GFI device in lieu of a GFI receptacle as required complying with NEC requirements for readily accessible devices.

J. BRANCH CIRCUIT REMOTE GFI PROTECTION DEVICES

01 DEAD FRONT GFI: (20 amp, 125v/3 wire), Legrand 2087 or Hubbell GFBFHP20 (LED Indicators, Auto Self-Test) (Red if on generator)

a. Blank Face

b. 1.5HP Switch Rated

c. Provide standard receptacle with remote dead front GFI device in lieu of a GFI receptacle as required to comply with NEC requirements for readily accessible devices.

02 HARD WIRED GFI MODULE (30 amp rated, 125v/3 wire, 240v/3 wire, 120/240v/4 wire, 250v/4 wire, or 208Y/120v/5 wire), Hubbell GFHW (LED Indicators, Auto Self-Test, Automatic Reset)

a. In-line wired at end device.

b. Class A GFCI.

c. Install in a readily accessible location to comply with NEC requirements.

K. CONVENIENCE OUTLET WITH USB CHARGING PORTS: (20 amp/125v/3wire),

01 20A, 120V Duplex Receptacle, Tamper Resistant

02 One (1) type-A USB port, 1.5 Amp, 5 Volt DC

03 One (1) type-C USB port, 55 Watt, 20 Volt DC

04 Hubbell USB20ACPDx or equal.

L. SPECIAL DEVICES: Refer to Drawings; all devices shall be specification or industrial heavy-duty

grade. Provide matching cord and cap.

M. PLATES:

01 Provide combination and/or gangable plates where adjacently located multi-outlet assemblies are indicated on drawings which shall include multi-switch installations.

02 Provide Type 302/304 smooth stainless steel plates with stainless steel mounting screws for typical devices.

a. Plates for surface mounted switch or outlet boxes shall be Sierra galvanized steel handy box plates (H series).

b. Provide powder coated steel faceplates with matching mounting screws where specific colors are indicated such as on stages.

03 Standard plate sizes only. Trademaster, Medium, or Jumbo plates are not acceptable.

N. OUTDOOR COVERS:

01 Electrical devices noted “WP” shall have weatherproof covers.

02 Devices installed under canopies or other areas not subject to direct rainfall shall have aluminum self-closing covers that are rated for wet location with cover closed. Hubbell MX Series, Legrand CA Series, or equal.

03 Devices subject to direct rainfall shall have a die-cast, aluminum, in-use cover rated for wet location with cord connected to device. Hubbell WP26M Series, Legrand WIUCAST1, or equal.

04 Convenience receptacles in interior spaces such as in a mechanical space or shop space not intended to serve specific equipment shall have aluminum self-closing covers that are rated for wet location with cover closed. Hubbell MX Series, Legrand CA Series, or equal.

05 Receptacles in interior spaces to be utilized for use with specific equipment such as in a kitchen or shop space shall have a die-cast, aluminum, in-use cover rated for wet location with cord connected to device. Hubbell WP26M Series, Legrand WIUCAST1, or equal.

O. INTERIOR FLOOR OUTLETS:

01 Single Service Locations:

a. For standard receptacles and outlets mounted in floors provide Legrand Wiremold 880 OMNI floor boxes.

b. For furniture feed floor outlets provide Legrand Wiremold EFBFF-OG floor boxes.

c. Provide cast iron, on-grade style for ground level floors, and fire rated steel type for above grade floors.

d. Provide cover with hinged access openings.

02 Multi Service Locations

a. Floor receptacles, data, A/V or telephone outlets served through U. L. fire rated floor structures shall use Legrand Wiremold Evolution Series Recessed 8 Inch Poke-Thru assembly with cover.

b. Floor receptacles, data, A/V or telephone outlets at grade level shall be installed in Legrand Wiremold Evolution Series 6-gang adjustable box with cover.

1) Wiremold EFB6-OG

c. Provide matching device plate for power receptacles and low voltage devices.

d. Provide blank inserts for unused spaces.

e. Provide dividers to maintain separation between different services.

03 Provide matching heavy duty hinged metal floor cover and ring to match floor material listed on Architectural Floor Finish Schedule. Color and cover shape shall be selected by Architect.

04 Legrand Wiremold Evolution Series floor boxes only, no substitutions.

P. EXTERIOR IN-USE FLOOR BOXES:

01 Single service, 2-gang, nonmetallic, flush in-grade ground box. UL listed to UL50E Type 6P and IP68 requirements while in use. Tested to UL2996 for use in the ground in all weather conditions. Cover assembly and ground box body shall be by same manufacturer to maintain UL listings. Tamper-resistant, locking cover assembly. Interlock boxes at same location. Box and cover assembly finish shall be selected by Architect.

a. 20A, 120V Cover Assembly: NEMA 6P rated wiring enclosure with two (2) pre-wired NEMA 5-20R duplex receptacles. UL50E type 6P & IP68 rating in outdoor locations.

b. NEMA Receptacle Cover Assembly: NEMA 6P rated wiring enclosure with pre-wired NEMA resistant receptacle. UL50E type 6P & IP68 rating in outdoor locations.

c. Low Voltage Cover Assembly: Able to accept up to 12 communication ports or 8 AV devices. Cabling and termination by installing contractor. UL50E type 4X & IP65 rating in outdoor locations.

02 Basis of Design:

a. 20A, 120V Assembly:

1) Legrand XB814C520xx

b. NEMA Receptacle Assembly:

1) Legrand XB814Cyyyxx

2) Provide receptacle type matching circuit/drawings. Confirm type during submittal.

c. Low Voltage Cover Assembly:

1) Legrand XB814CLVxx

d. Equal by Hubbell or FSR shall be acceptable.

END OF SECTION 26 27 26

SECTION 26 28 00

LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

PART 2 - MATERIALS AND METHODS

2.1 FUSED AND SAFETY DISCONNECT SWITCHES

A. GENERAL: Provide a safety disconnect switch for each motor, motor starter, electric duct heater and other equipment required by the NEC. Provide fusible where shown. Switches shall be listed for use with 75° C wiring. All products shall be manufactured in the United States.

01 Provide fusible, double throw disconnect for lift station service disconnect. Reference lift station electrical schematic for sizing and specifications.

B. COORDINATION:

01 Where switches are mounted on equipment they shall not interfere with access to equipment nor removal of service panels.

C. TYPE:

01 Heavy duty switch sized for load served; non-fusible where used purely as disconnect device.

02 Switches shall have minimum rating equal to upstream overcurrent protection amperage and voltage or as indicated on the drawings, whichever is greater.

03 Fused switches shall accommodate Class RK1 or RK5 fuses.

04 Combination starter disconnect switch shall be provided by Division 23 where shown on the drawings.

05 Disconnect switches for motors controlled by variable frequency drives shall have auxiliary “early break” contact to turn off VFD when motor is disconnected.

D. ENCLOSURE:

01 Provide NEMA 1 enclosure for switches inside, and NEMA 3R for switches outside unless otherwise noted to be NEMA 4X stainless steel on the Drawings or specifications.

02 Switches located in the kitchen area shall be NEMA 4X stainless steel.

03 Switches located within 50ft of a cooling tower shall be NEMA 4X stainless steel.

E. FUSES: Refer to section on fuses.

F. NAMEPLATE: Provide each device with an engraved nameplate showing load served, voltage, and circuit number.

G. MANUFACTURERS: GE Industrial (ABB), Siemens, and Square D.

2.2 ENCLOSED CIRCUIT BREAKERS

A. TYPE: Single or multi-pole circuit breaker suitable for the short circuit requirements as listed on the Drawings.

B. ENCLOSURE:

01 Provide NEMA 1 enclosure for circuit breakers inside, and NEMA 3R for circuit breakers outside unless otherwise noted to be NEMA 4X stainless steel on the Drawings or specifications.

02 Circuit breaker enclosures located in the kitchen area shall be NEMA 4X stainless steel.

03 Circuit breaker enclosures located within 50ft of a cooling tower shall be NEMA 4X stainless steel.

C. NAMEPLATE: Provide each device with an engraved nameplate showing load served, voltage, and circuit number.

D. LARGE TRANSFORMERS: Provide adjustable type breakers for overcurrent protection of all low voltage transformers 112.5kVA and larger.

E. LARGE MOTORS AND EQUIPMENT: Circuit breakers serving 50 hp and larger motors or large equipment such as chillers shall be adjustable type coordinated with the starting requirements of the equipment.

F. COORDINATION STUDY: Provide an electrical coordination study to determine settings of adjustable circuit breakers to match equipment served. Include revised setting of adjustable circuit breakers during the warranty period required to eliminate nuisance tripping. Provide copy of the coordination study with closeout documents.

G. MANUFACTURERS: GE Industrial (ABB), Siemens, and Square D.

2.3 FUSES

A. GENERAL: Provide fuses for all fused switches and noted on the Drawings and schedules.

B. TYPE: Fuses to 600 amps shall be low peak, dual element, time delay fuses – LPS Class RK1. Larger fuses shall Limitron KTU Class L fuses.

C. SPARES:

01 Reference 260010 Closeout Requirements.

D. MANUFACTURERS: Bussman, Littelfuse or approved equal

END OF SECTION 26 28 00

SECTION 26 29 00

LOW-VOLTAGE CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

PART 2 - MATERIALS AND METHODS

2.1 PHASE LOSS MONITOR

A. Motor starters not in motor control centers are provided under Division 23.

B. For each motor starter, provide and install a Time Mark Series 18 monitor. Wire into starter control circuit to de-energize motor on phase loss, phase reversal or low voltage. Unit automatically resets after fault conditions are corrected, after adjustable time delay. Do not provide for chiller, DX compressor motors, or motors controlled by a VFD. Adjust trip level to 20% below motor voltage and trip delay to mid-scale. Re-adjust set points at the Engineer’s direction should frequent, nuisance tripping occurs.

2.2 MANUAL MOTOR STARTER WITH THERMAL OVERLOAD AND PILOT LIGHT.

A. All switches shall have minimum rating of upstream overcurrent protection.

B. All switches shall have red pilot light integral to the switch cover.

C. All switches shall have an integral thermal overload unit to protect downstream devices. Coordinate thermal overload unit with device to be protected.

D. Where switches are used as disconnecting means the switch shall be lockable in accordance with NEC (2020) 110.25. Provide integral locking tabs on enclosure or lockable switch bracket mounted to the device plate. P&S 7801-P or equal.

E. Acceptable manufacturers: Square D FG Series or equal by GE Industrial (ABB), or Siemens.

2.3 CONTACTORS

A. GENERAL: Contactors shall have poles and rating consistent with the load being served but shall have a minimum of three poles, 30 amps (20 amps tungsten) per pole at 600 volts. The load may consist of all types of ballast and tungsten lighting, resistance and motor loads. Contactors for lighting control shall be provided with a minimum of two (2) spare poles for future use.

B. CONTACTS: The unit shall have 100% rated double-break, silver-cadmium-oxide power contacts, field convertible from N.O. to N.C. and vice-versa and with clearly visible N.O. and N.C. contact-status indicators.

C. CONTROL: The unit shall be electrically held installed in a NEMA 1 enclosure. Provide HOA switch to allow manual control of lights. Provide NEMA 3R enclosure for exterior locations or as indicated on the drawings.

01 Coordinate with BAS controls contractor to provide coil voltage matching BAS design for all circuits controlled by the BAS.

02 For all other circuits provide 120 volt coil. Provide controls transformer with input and output fusing if circuit controlled is not 120 volt.

D. LABELING: List circuits controlled inside enclosure. Provide contactor nameplate.

E. ACCEPTABLE MANUFACTURERS: GE Industrial (ABB), Siemens, and Square D.

2.4 TIME CLOCKS

A. GENERAL: Contacts shall have poles and rating consistent with the load being served but shall have a minimum of two circuits, 20 amps per circuit at 277 volts. The load may consist of all types of ballasts, resistance and motor loads. Provide NEMA 3R enclosure in wet locations.

01 Provide time clocks for the specified systems when not controlled by the BAS.

B. Astronomical Time Clock: Two circuit, seven day operation with battery backup. Intermatic Model ET8215C

C. Water Heater & Circulation Pump Time Clock: Electronic programmable timer with battery backup. Intermatic EH40 with 2T2926A enclosure.

END OF SECTION 26 29 00

SECTION 26 32 13

PACKAGED GENERATOR ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

1.2 RELATED WORK

A. Section 23 09 23 – Direct Digital Control System for HVAC

B. Section 23 09 93 – Sequence of Operations for HVAC Controls

C. Section 26 24 00 – Switchboards and Panelboards

D. Section 26 36 13 – Manual Transfer Switch

E. Section 26 36 23 – Automatic Transfer Switch

PART 2 - MATERIALS AND METHODS

2.1 STANDBY GENERATOR

A. GENERAL: The unit shall operate on natural gas and be constructed for outdoor installation. A generator monitor panel and transfer switch shall be located remotely in the facility.

B. ACCESSORIES:

01 Provide digital display to monitor load power conditions, adjusting transfer switch parameters, monitoring network status and reviewing transfer switch events. Monitor shall be password protected to limit access to adjustments and key lock protected to prevent unauthorized activation of transfer or test functions.

02 Standard weather enclosure with residential muffler and rain cap.

03 AC output line circuit breakers as indicated on the drawings.

04 Starter batteries.

05 Generator Electrical Accessories:

a. Alternator Heater: Single point 300 watt, heater at 120V single phase.

b. Coolant Heater: 1500W at 120V single phase.

c. Battery Charger: 10 amp, 24 volt battery charger at 120V single phase.

d. Provide remote annunciator. Confirm location with Owner.

e. Remote E-stop shutoff/disconnecting means per NEC requirements, confirm location with Owner.

1) Red mushroom type.

2) Flush or surface mounted as directed by the Owner.

06 Voltage sensing dry contact to verify AC power generation.

07 Complete oil and coolant charge with anti-freeze to 0° F.

08 Gas pressure reducing valve and flexible hose with stainless steel wire braid covering for natural gas connection. Service gas pressure will be 5 psi.

09 Cables between unit, batteries, charger, controller, remote annunciator and transfer switches.

C. FACTORY TESTING: After installation provide complete startup and checkout of generator and transfer switch. Provide 8 hour load test and run-in with full load following startup. Test results to be provided as part of close out documents.

D. FINAL SYSTEM APPROVAL: The final approval test of the generator system shall consist of opening the building main circuit breaker to simulate a system power failure. Generator shall start and automatically transfer power to the emergency electrical panels. After operation of emergency loads are verified, main circuit breaker will be closed. Generator system shall wait the prescribed time then automatically transfer these loads back to the utility service. Generator shall wait the prescribed time then shut off. Test shall be performed by the factory authorized representative and witnessed by SEG and school personnel.

E. SUBMITTAL DRAWINGS:

01 Provide engineered drawings showing equipment dimensions and connections.

02 Provide installation and wiring drawings for the standby generator and transfer switch system.

03 Include equipment description noting capacity and accessories, and a service/operation manual.

04 Provide maximum fault current available that the generator can deliver.

05 COORDINATION: Generator breaker selection(s) shall be made as a result of the electrical system coordination study generated by the Division 26 contractor. Refer to 262400 for coordination study requirements.

06 All information shall be in pdf format.

07 Reference 260000 General Electrical Requirements for additional information.

F. TRAINING:

01 Reference 260010 Closeout Requirements.

G. WARRANTY:

01 Reference 260010 Closeout Requirements.

H. SERVICE CONTRACT:

01 Reference 260010 Closeout Requirements.

I. CLOSEOUT DOCUMENTS:

01 Reference 260010 Closeout Requirements.

J. ACCEPTABLE MANUFACTURERS: Caterpillar, Kohler, Onan/Cummins, and Taylor Power Systems. Must be provided as a factory package with the automatic transfer switch by the generator manufacturer.

END OF SECTION 26 32 13

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

1.2 RELATED WORK

A. Section 25 50 00 – Direct Digital Control System for HVAC

B. Section 25 95 10 – Sequence of Operations for HVAC Controls

C. Section 26 32 13 – Packaged Generator Assemblies

D. Section 26 36 13 – Manual Transfer Switches

PART 2 - MATERIALS AND METHODS

2.1 AUTOMATIC TRANSFER SWITCH

A. GENERAL: Provide transfer switch matched to generator output capacity. Switch shall have three poles with neutral bar. Provide NEMA 1 enclosure where mounted inside, and NEMA 3R where mounted outside unless noted to be NEMA 4X stainless steel on the Drawings. Where located in the kitchen areas or within 50ft of cooling towers the enclosure shall be NEMA 4X stainless steel. Provide switching sequence compatible with the electrical utility requirements.

B. RATINGS: 480 volts, 3 phase with minimum current rating as indicated on the drawings. Unit shall have a minimum long-time/closing rating of 14,000 AIC independent of the system circuit breaker and fully rated AIC as part of a listed, series combination with the specific circuit breakers installed upstream of the switch.

C. ACCESSORIES:

01 Basic indicator panel

a. Source available/connected LED indicators

b. Test/exercise/override buttons

02 Analog LED bar graph display capable of displaying 3-phase voltage, current, frequency, power factor and kilowatts with LED status indicators.

03 Programmable exerciser with weekly and monthly scheduling.

04 Extended start time delay (0 to 90 seconds).

05 Programmed transition (0 to 60 seconds).

06 Over/undervoltage sensing.

07 Over/under frequency sensing.

08 24 volt coil auxiliary relay with 2-NO and 2-NC dry contacts.

09 Additional auxiliary contacts indicating source connection, source availability, equipment settings and alarms to be monitored external systems.

10 True three phase monitoring and phase loss detection.

a. System shall automatically start the generator and transfer with the loss of any phase.

D. EXERCISER SETTINGS: Exerciser schedule day and time to be coordinated with the Owner.

E. SUBMITTAL DRAWINGS:

01 Provide engineered drawings showing equipment dimensions and connections.

02 Provide installation and wiring drawings for the standby generator and transfer switch system.

03 Include equipment description noting capacity and accessories, and a service/operation manual.

04 Provide AIC series rating tables for selected ATS.

a. Highlight series rating of ATS with upstream generator and upstream normal power circuit breakers.

b. Coordinate upstream breakers with selected ATS to ensure sufficient AIC of the system for all available fault currents.

05 COORDINATION: Generator and normal power breaker selection(s) shall be made as a result of the electrical system coordination study generated by the Division 26 contractor. Refer to 262400 for coordination study requirements.

06 All information shall be in pdf format.

07 Reference 260000 General Electrical Requirements for additional information.

F. TRAINING:

01 Reference 260010 Closeout Requirements.

G. WARRANTY:

01 Reference 260010 Closeout Requirements.

H. CLOSEOUT DOCUMENTS:

01 Reference 260010 Closeout Requirements.

I. EXERCISER SCHEDULE:

01 Initial setting shall be Sundays at 10:00am. Adjust settings as directed by the Owner.

J. ACCEPTABLE MANUFACTURERS: Caterpillar, Eaton, Kohler, and Onan/Cummins Power Generation. Must be provided as a factory package with the generator by the generator manufacturer.

END OF SECTION 26 36 23

SECTION 26 43 00

SURGE PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

1.2 ABBREVIATIONS

A. TVSS Transient Voltage and Surge Suppressor

B. SPD Surge Protection Devices

C. The terms TVSS and SPD shall be used interchangeably where they appear in these documents.

PART 2 - MATERIALS AND METHODS

2.1 EXTERNAL TRANSIENT VOLTAGE SURGE SUPPRESSOR (TVSS/SPD)

A. GENERAL: Provide external SPD equipment for electrical panels and equipment where noted on the Drawings. Some equipment may be noted to have SPD integral to panel or switchboard.

B. QUALITY CONTROL: The qualified manufacturer shall have been engaged in the commercial design and manufacture of surge suppression products specified herein for a minimum of five (5) years.

C. INSTALLATION: External SPD shall be installed in NEMA 1 housing and mounted adjacent to the equipment to be protected. Provide NEMA 4X housing in the central plant, boiler rooms and exterior locations. Provide a three pole circuit breaker in the panel or direct bus connection with integral OCPD and disconnect within SPD cabinet. Connect SPD with wiring as short and straight as possible.

D. DISPLAY: Provide LED status indicators and digital transient counter with battery backup.

E. ALARM: Provide audible alarm with silence and test function.

F. SUPPRESSION MODES: System shall provide suppression of L-L, L-N, L-G and N-G transients.

G. RESPONSE TIME: 1 nanosecond or less.

H. EMI/RFI ATTENUATION: 38 dB or better.

I. MONITORING: Provide remote monitoring contacts, dry, 1 form C type, rated for 120V, 1A (30A VDC, 2A).

J. MINIMUM SPD RATING:

01 Panels smaller than 400 amps: 100 kAmps per phase

02 Panels 400 amps up to 800 amps: 150 kAmps per phase

03 Panels 801 amps up to 2000 amps: 240 kAmps per phase

04 Panels greater than 2000A: 400 kAmps per phase

05 Reference drawings for scheduled SPD ratings which may exceed the minimum values indicated here.

K. STARTUP:

01 Factory trained personnel shall provide start up on TVSS equipment including verification of proper operation using appropriate diagnostic equipment.

02 Provide copy of startup testing results with closeout documentation.

L. WARRANTY:

01 10 year, non-prorated replacement.

02 Manufacturer's warranty shall initiate after the Owner has accepted the testing results described herein and taken possession of the equipment.

03 Provide a copy of a manufacturer's warranty statement with closeout documentation.

M. ACCEPTABLE MANUFACTURERS: GE Industrial (ABB), Siemens, and Square D.

2.2 SPECIAL EQUIPMENT TRANSIENT VOLTAGE SURGE SUPPRESSOR (SPD)

A. EQUIPMENT PROTECTED: Install for fire alarm panel, security panel, access control panel and CCTV panel branch circuits, including all sub panels and power supplies.

B. INSTALLATION: Install device in junction box surface mounted in mechanical/electrical rooms or above accessible ceiling if equipment is not in mechanical/electrical room. The branch circuit shall terminate on the SPD and then subfeed the equipment. The wire between the device and the equipment shall be approximately three to five feet long.

C. SPD MODEL:

01 Ditek Model DTK-120SRD surge suppressor with dry contacts

a. Provide for fire alarm systems. Fire alarm system to monitor contacts.

02 Space Age Electronics E120V-GT Hybrid Surge Protector

END OF SECTION 26 43 00

SECTION 26 50 00

LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00.

PART 2 - MATERIALS AND METHODS

2.1 LIGHT FIXTURES

A. GENERAL: Provide all fixtures as shown, completely wired and securely attached to supports. Include all necessary accessories including heavy duty, chrome plated wire guards on high bay and indirect HID fixtures, and over exit lights located in the athletic areas. Fixture models scheduled are to show general type of fixtures required. Furnish mounting design and trim to fit type of ceiling and finish on which fixture is to be installed. Fixture shall be designed to operate satisfactorily where installed including the required fire proofing. All lens doors shall securely attach to the housing with spring operated latches to prevent release due to vibration or gravity.

B. PAINT: All fixture housings shall have a complete coverage of white enamel or baked polyester powder finish with 85% minimum reflectivity.

C. PLASTIC REFRACTORS/DIFFUSERS: Material shall be light-stable 100% virgin acrylic with a nominal thickness of .125".

01 Provide non-conductive "dead front" lens/reflector for shower fixtures.

A. LED FIXTURES: LED lamps shall be 4000K color temperature with a minimum CRI of 80 or as noted on the drawings/schedules and shall come standard with 0-10V dimming and a minimum five (5) year warranty on LED boards, drivers, and components. All LED fixtures shall be DesignLights Consortium (DLC) or EnergyStar certified. Models shall have a minimum projected life of 50,000 hours at 90% lumen output using IESNA LM-79, LM-80 and TM-21 standards. Submittal information must contain projected L90 lifetimes using TM-21 data at minimum 25°C (77°F) for all interior fixtures.

D. LED DRIVERS: LED drivers shall be electronic-type, labeled as compliant with radio frequency interference (RFI) requirements of FCC Title 47 Part 15, and comply with NEMA SSL 1 "Electronic Drivers for LED Devices, Arrays, or Systems". LED drivers shall have a sound rating of "A", have a minimum efficiency of 85%, and be rated for a THD of less than 20 percent at all input voltages.

01 Dimmable LED fixtures shall have a 0-10 volt, 3-wire, phase, or a two-step (50%-100%) line voltage, two switch controlled dimming driver, as shown on the drawings. Dimmable LED drivers shall be capable of dimming without LED strobing or flicker across their full dimming range.

02 Drivers shall be rated for the ambient temperatures and conditions in which they are located.

a. Fixtures in wet locations shall be equipped with wet rated drivers.

b. Fixture in cold locations shall be equipped with drivers designed for reliable starting to -20° F.

c. Indoor fixtures located in areas with above normal ambient temperatures shall have high ambient drivers rated at 55° C minimum.

d. Reference drawings for additional requirements.

03 Drivers shall be warranted for minimum five (5 years from date of substantial completion of the project.

E. FIRE PROTECTION: Provide fixture fire protection as required by U. L. Fire Resistive Index for the type ceiling to be installed. Provide additional fireproofing as required by the local building code. Protection is specified under the Ceiling Section of these Specifications.

F. SUPPORT: Securely support fixtures to prevent the fixture from falling. Lay-in fixtures shall be supported per the ceiling fire rating as specified by the Architect. Surface and pendant fluorescent fixtures shall be supported with two supports per four foot section. Provide caddy clips for recessed fixtures. Pendants for indirect light fixtures shall be securely attached to structure or Unistruts across joists using threaded connections. High bay fixtures shall have manufacturer supplied quick disconnect mounting hardware and safety cable.

G. CONSTRUCTION: Provide stainless steel hardware for exterior fixtures and fixtures in wet locations.

H. SURGE PROTECTION: Exterior fixtures shall include integral 10kV surge protection.

I. SEALING: All conduits, junction boxes and other penetrations of the building envelop shall be sealed with non-hardening caulking or other non-hardening material as required by the International Energy Conservation Code. Provide caulking or gasketed seals around fixtures to prevent water ingress.

J. LIGHT POLES: All poles shall be selected to support the scheduled fixtures and equipment per ASCE/SEI 7 minimum design loads or 120 MPH wind loading plus 1.3 gust factor, whichever is greater. Provide a reinforced concrete support base per the Drawing Details. Provide pole base cover to conceal lighting standard anchor bolts. Provide additional grouting as required/directed by the Owner/Engineer.

K.

2.2 EMERGENCY BACKUP:

A. EMERGENCY POWER PACKS: Emergency battery packs/drivers shall be high output, self-contained, and mounted internal to fixture. Units shall be long life nickel cadmium sized for 90 minute operation with a 120/277 volt solid state charger and automatic transfer switch.

01 Unit shall provide a minimum nominal 1400 lumen output from the specified LED or fluorescent lamps. Where 1400 lumens exceeds the standard capacity for the scheduled fixture, the emergency battery pack/driver with the maximum capacity shall be provided.

02 Units shall be rated for the ambient temperatures and conditions in which they are located.

a. Fixtures in wet locations shall be equipped with wet rated units.

b. Fixture in cold locations shall be equipped with units designed for reliable operation to -20° F.

c. Fixture located in areas with above normal ambient temperatures shall have high ambient units rated at 55° C minimum.

d. Reference drawings for additional requirements.

03 Emergi-lite, Iota, Bodine or approved equal.

B. EMERGENCY TRANSFER RELAYS: Provided under 26 09 43 Network Lighting Controls

C. REMOTE EMERGENCY INVERTER: Remote emergency inverters shall be high output, self-

contained, and mounted in an electrical room, mechanical room, or where indicated on the drawings. Plenum rated inverters may be installed above accessible ceilings in the same room as the fixtures they feed. Solid-state indicator lights shall signal operational status. The inverter shall allow the connected fixture(s) to be on, off, switched, or dimmed without affecting emergency operation and regardless of local switch position.

01 Units shall contain sealed lead-calcium VRLA batteries, charger and electronic circuitry in a single housing with a 120/277 volt solid state charger and automatic transfer switch. Inverter load and battery capacity shall be sized for 90 minute operation at 125% of the designated wattage; for example no more than 200W of lighting on a 250W inverter.

02 Provide an audible and visual alarm when an output distribution circuit breaker is open or has tripped.

03 Provide contacts to be monitored by an exterior system.

a. Contacts shall include but not be limited to:

1) Inverter Fault

2) Test Failure

3) Circuit Breaker Trip Alarm

4) Inverter On/Off Status

5) Inverter State (Battery versus Utility)

04 Provide minimum 2 year warranty on all inverters.

05 Refer to drawings for additional requirements.

06 Crucial Power, Emergi-lite, Evenlite, Iota, Bodine, Meyers or approved equal.

2.3 SPORTS LIGHTING

A. Lighting for sports fields and the performance requirements are provided under separate contract.

2.4 SPARE PARTS AND ATTIC STOCK:

A. Provide the following spare devices:

01 Reference 260010 Closeout Requirements.

B. Electrical contractor shall include in his bid the cost to provide and install the additional spare parts and associated wiring as directed by the Owner/engineer. All devices not used during construction shall be turned over to the Owner at the time of job completion.

2.5 WARRANTY:

A. Reference 260010 Closeout Requirements.

END OF SECTION 26 50 00

SECTION 26 56 68 EXTERIOR ATHLETIC FIELD LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA and ANSI Standards and be so labeled.

E. Provide Shop Drawings per Section 26 00 00 and as detailed below.

1.2 SUMMARY

A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.

B. The purpose of these specifications is to define the lighting system performance and design standards for a new competition football field and covered practice field at New Caney High School using an LED Lighting source.

01 The manufacturer shall be directly contracted under the scope of this project to supply and install the sports lighting equipment, fixtures, poles, and control system. All necessary components for a complete installation including internal electrical wiring, pole foundations, etc. related to the sports lighting system shall be performed by the manufacturer and their selected contractors.

02 The General Contractor shall coordinate the work performed by their subcontractors with the sports lighting manufacturer and their subcontractors.

03 The project Electrical Contractor shall provide power and pathways from the campus power distribution system to the sports lighting system components and make final connections to equipment provided by the sports lighting installer.

04 The project Electrical Contractor shall provide pathways for campus low voltage systems to be installed on or connected to the sports lighting equipment.

C. Scope of Services

01 General Contractor’s Responsibilities

a. General:

1) Complete access to the site for construction using standard 2 wheel drive rubber tire equipment

2) Locate existing underground utilities not covered by local utilities, i.e. water lines, electrical lines, irrigation systems, and sprinkler heads. Sports Lighting Manufacturer or their subcontractor will not be responsible for repairs to unmarked utilities.

3) Locate and mark field reference points per Sport Lighting Manufacturer’s supplied layout. (i.e. home plate, center of FB/SO field)

4) Pay for extra costs associated with foundation excavation in non-standard soils (rock, caliche, high water table, collapsing holes, etc). Standard soils are defined as soils that can be excavated using standard earth auguring equipment.

5) Provide any existing as-built documents or drawings (if available).

6) Provide area on site for disposal of spoils from foundation excavation.

7) Provide haul off for disposal of spoils not to be reused in site preparation.

8) Provide area on site for pole lay down, dumpsters, etc.

02 Electrical:

a. Provide new electrical service per the necessary power company requirements.

b. Provide labor, equipment, and materials to provide new electrical equipment (breaker panels, underground infrastructure) to support the new sports lighting system.

c. Conduit pathways for campus electrical systems shall be routed through the site to the location of the sports lighting control cabinets. Site conduits shall be stubbed up and capped for future extension.

d. Wiring to poles shall be terminated at the sport's lighting system disconnect enclosures.

e. Provide dedicated 120V circuit to Sports Lighting Control hub and control switches at owner designated location.

f. Mount and power up Sports Lighting Control hub.

g. Provide and install emergency lighting fixtures on sports lighting poles and backup inverters.

03 Sports Lighting Manufacturer's Responsibilities

a. Provide required fixtures, cross-arm assemblies, poles, wire harnesses, disconnect and remote power supply enclosures, and control system.

b. Provide design layout, aiming diagrams, and remote installation assistance.

c. Provide sign and sealed foundation designs based on standard soils or based on Owner provided Geotech report (if available).

d. Remotely commission controls (with subcontractor assistance) and train staff.

e. Assist the installing sports lighting subcontractor and ensure all parties' responsibilities are satisfied.

04 Sports Lighting Manufacturer's Subcontractor's Responsibilities

a. General:

1) Provide equipment and materials to off load equipment at jobsite and/or subcontractor's facility per scheduled delivery.

2) Provide on-site storage containers and adequate security to protect sports lighting products from theft, vandalism, or damage during installation (if necessary.)

3) Obtain any required permitting for the sports lighting system.

4) Provide necessary waste disposal and daily cleanup.

5) Confirm existing underground utilities and irrigation systems have been located and are clearly marked so as to avoid damage from construction equipment. Repair any such damage during construction.

6) Keep all heavy equipment off playing fields when possible. Repair damage to grounds which exceeds that which would be expected. Indentations caused by heavy equipment traveling over dry ground would be an example of expected damage. Ruts and sod damage caused by equipment traveling over wet grounds would be an example of damage requiring repair.

7) Provide startup and aiming as required to provide complete and operating sports lighting system.

b. Foundations, Poles, and Light Fixtures:

1) Mark and confirm pole locations per the aiming/installation diagram provided. If there are any issues or changes immediately notify Sports Lighting Manufacturer's project manager.

2) Provide labor, materials, and equipment to install Sports Lighting Manufacturer's provided poles and light fixtures specified on layout and per the sign and sealed foundation designs.

3) Provide labor, materials, and equipment to connect Manufacturer's control cabinets to site conduit stub ups.

4) Provide labor, materials, and equipment to install Sports Lighting Manufacturer's provided wire harness, remote power enclosures, and disconnect enclosure on each pole, aim light fixtures per provided diagram, and make all electrical connections at top of pole and into disconnect enclosure.

5) Upon mounting of light fixtures to cross-arms remove two MAC address stickers (one will be permanent on the fixture, remove the other 2) from driver enclosure. Sticker to be affixed to installation drawing or provided tracking sheet to assist in remote controls commissioning.

6) Place spoils to designated location on site.

7) Provide mounting point for emergency fixtures on designated poles.

D. The sports lighting will be for the following venues:

01 Football Fields

02 Covered Practice Field

03 Pedestrian Walkways at Football Field Bleachers.

E. The primary goals of this sports lighting project are:

01 Guaranteed Light Levels: Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore, light levels are guaranteed to not drop below specified target values for a period of 10 years.

02 Environmental Light Control: It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators, and neighbors.

03 Cost of Ownership: In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.

04 Control and Monitoring: To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system.

F. All lighting designs shall comply with New Caney, TX lighting ordinances.

1.3 ACCEPTABLE MANUFACTURERS:

A. Acceptable manufacturers shall be Ephesus or equal with prior written approval.

1.4 LIGHTING PERFORMANCE

A. Illumination Levels and Design Factors: Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below for each individual field/court. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

Area of Lighting	Average Target Illumination Levels	Maximum to Minimum Uniformity Ratio	Grid Points	Grid Spacing
Football Field	50 foot candles	2.0:1.0	72	30’ x 30’
Covered Field	50 foot candles	2.0:1.0	72	30’ x 30’
Walkways	IES Recommended	Per IES	Varies	10’ x 10’

A. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 75.

B. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal. Fixtures at the football field shall be installed on sports lighting poles provided under this specification. Fixtures at the covered practice field shall be mounted on the covered practice field structure provided by others as part of this project.

Football Field:

# of Poles	Pole Designation	Pole/Fixture Height
4	F1,F2,F3,F4	100’

Covered Practice Field:

# of Columns	Column Designation	Fixture Height
5	CF-1,CF-2,CF-3,CF-4,CF-5	Varies

PART 2 - MATERIALS AND METHODS

2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION

A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.

B. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.

C. System Description:

01 Lighting system shall consist of the following:

a. New LED sports lighting fixture and controls.

b. New sports lighting poles designed, provided, and installed as part of the sports lighting package. The poles shall consist of steel poles utilizing concrete foundations. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long-term performance concerns.

c. All luminaires, visors, and cross-arm assemblies shall withstand 140 mph winds and maintain luminaire aiming alignment.

02 Manufacturer will supply all drivers and supporting electrical equipment

a. Remote drivers and supporting electrical equipment shall be serviceable and enclosed in non-rusting, weather proof enclosure or actual fixture. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Local drivers at the fixture shall not be acceptable.

b. Remote drivers and supporting electrical equipment shall be installed at approximately 10ft AFF at a serviceable height.

c. Connection from the campus power distribution system to the sports lighting system shall be at the remote driver enclosure at each pole or column by Division 26 under this contract.

d. Manufacturer shall provide surge protection at the pole equal to or greater than 40 kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2_2002.

03 Sports lighting controller to be installed in the ticket booth within the football stadium press box structure with a remote scene switch located at the covered practice field.

a. Wireless mesh communication control system with cellular data communication system provided by sports lighting manufacturer.

b. 120V power connection provided by Division 26 under this contract.

c. Raceway to remote antenna by Division 26 under this contract. Location of antenna to be field located by sports lighting contractor.

04 Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.

a. Wire harness from remote drivers to fixtures on cross arms above shall be installed by sports lighting manufacturer or their selected contractor.

05 Manufacturer shall provide lightning grounding as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A.

a. Integrated grounding via concrete encased electrode grounding system.

b. If grounding is not integrated into the structure, the manufacturer or project lightning protection contractor shall supply grounding electrodes, copper down conductors, and exothermic weld kits.

c. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment.

d. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.

D. Safety: All system components shall be UL listed for the appropriate application.

2.2 POLE STRUCTURE SYSTEM

A. General description: The entire sports lighting system (poles, crossarms, wiring and fixtures) must be supplied by a single entity. The complete lighting system shall consist of the listed equipment as follows:

01 Design must adhere to 2018 IBC
02 Anchor based hot-dip galvanized steel poles.
03 Crossarms: tubular style factory pre-wired and assembled, no external wiring, side mounted plate-to-plate crossarm to pole connection, hot-dip galvanized steel. No top-mount attachment permitted
04 Grounding lug nut integral to pole system
05 Provide drop cables from crossarms to distribution box 10 feet above grade with plug and play connection
06 Fused power disconnect box in 3R rated enclosure
07 All wiring from the load side of the fused disconnect box to the luminaires.

08 For anchor base poles, must have gussets between shaft and plate connection to increase strength at base.
09 Pole shaft must adhere to ASTM A-572 GR65 and shaft form factor must be round, no multi-sided shafts permitted
10 Wind speed rating must adhere to ASCE 7-05 geographical standards

B. Coordination with other trades:

01 Egress area lights to be mounted on sports lighting poles. Reference drawings and schedules for fixture types and quantity. Provide mounting plate matching speaker attachment.
02 Public Address (PA) speakers to be mounted on sports poles. Reference drawings and schedules for fixture types and quantity. Provide mounting plates matching fixture attachment.
03 Provide handhole in sports lighting poles at ~30ft AFF to facilitate installation of egress lighting and PA speakers on the sports lighting poles.

2.3 FOUNDATIONS

A. The pole foundations shall be designed for allowable stresses in accordance with 2015 IBC standards, 140 mph windspeed. Foundation must be designed and stamped by Structural Engineer in the state of Texas. Installation and structure shall be based on wind speed criteria of these specifications.

B. Concrete material for concrete foundations – all concrete shall have minimum compressive strength of 3000 psi at 28 days. Concrete shall have maximum water/cement ratio of 0.5. Foundation installation shall be in accordance with the latest edition of ACI 336, Standard Specifications for the Construction of Drilled Piers.

C. Foundation strength – any concrete portions of the pole in which steel components that provide tension strength are contained, shall be allowed to harden for a minimum of 28 days before stress loads of pole attachment are applied.

D. Provide steel caissons where required to hold back collapse of augured hole and concrete backfill as recommended by the foundation design engineer.

E. Include excavation and removal of materials other than normal soils such as rock, calcite, etc.

2.4 POLE STRUCTURE

A. The poles shall be designed for allowable stresses in accordance with 2015 IBC.

B. The pole structure shall consist of a modular pole assembly.

C. Embedment shaft section shall be a single piece round tapered shaft section. The taper rate and material cross section properties shall match the adjoining section. The lower shaft section shall be embedded into the earth a minimum distance of 10% of the free-standing height of the structure plus 2’ or as recommended by engineer. The shaft section shall be galvanized in accordance with ASTM A123 specifications. The entire embedded shaft portion shall also be externally coated with Corrocote II epoxy coating or coal tar epoxy up to 6” above the ground line. Concrete stub pole sections are not acceptable due to excessive weight and structural design.

D. Each section of pole shaft material shall be of single-ply material and be made from a single sheet of steel with no circumferential welded splices. The pole shafts cross-section shall be round. The pole shaft sections shall be high-strength steel meeting the requirements of ASTM A572 GR65 (65 ksi yield)

E. Pole shaft sections shall be hot dip galvanized in accordance with the requirements of ASTM A123 specifications. Each shaft assembly must be completely coated, inside and out, in a single dip. Double dipping will not be permitted in compliance to USGA (United States Galvanizing Association) recommended practices and procedures to prevent acid entrapment. All miscellaneous connecting hardware shall be galvanized in accordance with ASTM A153 specifications.

F. The structure shall be designed for the combined effective projected area (EPA) and weight of all applicable accessories (i.e. luminaires, crossarms, remote cabinets and other components such as speakers/mounting brackets). Concrete poles or pole sections are not acceptable due to excessive weight and mobilization costs.

G. Wind loads – structure shall be based on the latest specifications of ASCE 7-05 and designed to withstand local wind speeds.

2.5 CROSSARM ASSEMBLY

A. All crossarms shall be factory pre-wired and assembled.

B. All crossarms shall be hot dip galvanized in accordance with the requirements of ASTM A123 specifications

C. All wiring/connections should be factory assembled from the fixture mounting location to the base of the pole.

D. Strain relief device(s) must be factory installed in pre-wired crossarm assembly to ensure no weight or tension is placed on electrical connections.

E. All factory pre-wiring must be done in a manner that requires no electrical connections inside the pole or crossarm assembly to be made in the field.

2.6 SPORTS LIGHTING SYSTEM

A. The lighting system shall meet the following specifications:

B. Sports Light Head:

01 UL Certified for wet locations
02 IP66 rated (total protection from dust and high pressure water in any direction)
03 Operating temperature range rating between -40°C and +40°C
04 Certified to UL 844 and ANSI C136.31
05 3G vibration rated
06 Efficacy of ≥130 lumens/watt
07 Correlated Color Temperature (CCT) of 5700K
08 CRI of ≥ 70
09 L90 lumen depreciation rating: >55,000 hours certified by LM80 testing
10 Light Head weight ≤ 57 lbs, including mounting bracket and hardware
11 Light Head effective projected area (EPA) ≤ 2.9 ft2
12 Pre-aiming for orientation and tilt
13 Luminaires must be listed on the QPL of Design Lights Consortium® to ensure minimum quality and energy-efficiency standards are met for qualification in energy efficiency programs.
14 Aluminum shall be chromate conversion coated and then two-stage architectural grade powder- coated for long term resistance to corrosion and UV exposure
15 Luminaires must be designed and tested for reliability in the USA
16 Luminaire shall incorporate silicone TIR optics to eliminate optical degredation
17 Multilayer optical system combining TIR optics with reflector optics to minimize glare perception.
18 Fixture shall have a sealed glass cover to protect the optics and LEDs from water ingress and optical degradation. No exposed TIR optics permitted.

C. LED light source shall be Chip-on-Board (COB) technology for proven reliability compared to discrete LEDs with solder joints prone to high failures.

D. Remote Power Enclosures:

01 Drivers, controls and all wiring connections shall be contained in IP66 enclosures. No exposed connections permitted.
02 Wide input range of 120VAC to 277VAC or 277VAC to 480VAC
03 Power factor: >0.96 @ 277VAC and >0.95 @480VAC
04 THD (Total Harmonic Distortion) ≤20%
05 Three level system surge protection: 40kV system front end, additional 10kV per power enclosure and additional 10kV per driver.
06 Drivers shall be mounted inside a cast aluminum enclosure which conducts heat away from the driver to ambient air and maintains a driver case temperature within the driver manufacturer's warranty limitations at 40°C ambient in order to preserve long term reliability.
07 No active cooling permitted
08 No open frame drivers permitted
09 No sheet metal cabinets permitted

10 No integral power solutions are permitted
11 Commercially available power supplies only (no custom drivers). If custom drivers are proposed a 25 year warranty shall be provided to support long term maintenance
12 All controls components housed in remote enclosures. No exposed antennas to protect from damage.

E. Controls

01 Communication
a. Wireless mesh communication control system with 10 years of cellular data communication included.

b. Communication to the on-site controller over direct connection to the Owner's local area network (LAN).

02 Functionality:
a. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.

b. Lighting contactor cabinet(s) (if required for system to operate and control lighting sequences) constructed of NEMA Type 4 aluminum, designed for easy installation with contactors, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

c. Dimming: System shall provide for infinitely variable lighting levels. Dimming will be set via local controller or remote software interface.

d. Dynamic Scenes: Controller shall be capable of programming at least 5 dynamic, paparazzi style scenes for each field. Alternate manufacturers utilizing hardwired touchscreens for control of dynamic scenes must provide one per field in an owner designated location. Contractor to provide all necessary wiring and cover costs of any plan revisions.

03 Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.
a. The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute "early off" commands by phone. Scheduling tool shall be capable of setting curfew limits.

b. Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

04 Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
05 Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.
06 Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.
a. Cumulative hours: shall be tracked to show the total hours used by the facility

b. Report hours saved by using early off and push buttons by users.

2.7 SAFETY

A. All system components shall be UL listed for the appropriate application.

2.8 ELECTRICAL

A. The electrical power requirements for the sports lighting system shall meet the following specifications:

01 Electrical Service: 480V 3 Phase
02 Energy Consumption: The total system kW consumption shall be 125,000W or less. System energy consumption will not increase as the system ages.
03 Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed three (3) percent of the rated voltage.

PART 3 - EXECUTION

3.1 DELIVERY TIMING

A. Delivery Timing Equipment On-Site: The equipment must be on-site 6-8 weeks from receipt of approved submittals and receipt of complete order information. The overall deadline of the project and substantial completion date will not be extended if there is a delay in delivery of fixtures to the site.

3.2 SOIL QUALITY CONTROL

A. It shall be the contractor’s responsibility to evaluate the Geotech report provided prior to bidding. No change orders will be permitted based on soil conditions. It is recommended that sign and sealed structural designs be developed prior to bidding in order to ensure correct foundations are accounted for.

B. Providing engineered foundation embedment design by a registered engineer in the State of Texas.

3.3 FIELD QUALITY CONTROL

A. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with the latest IESNA Sports and Recreational Area Lighting standards.

B. IES files shall be publicly available and provided to the engineer/specifier to verify the system lighting performance calculations.

C. Field Light Level Accountability
01 Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 10 years. These levels will be specifically stated as “guaranteed” on the illumination summary provided by the manufacturer.

02 The contractor/manufacturer shall be responsible for conducting initial light level testing and an additional inspection of the system, in the presence of the owner, one year from the date of commissioning of the lighting.

03 The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities. The changes shall be but not limited to additional light fixtures, additional wiring, circuit or structural supports to achieve the required foot candle levels documented above. Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

D. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed representative, the actual performance levels of the system are not in conformance with the requirements of the specifications and submitted information, the Contractor/Manufacturer shall be required to adjust to meet specifications and satisfy Owner. If specified system performance cannot be achieved the manufacturer shall remove the entire unacceptable lighting system and install a new lighting system to meet the specifications at no additional cost to the Owner.

3.4 WARRANTY AND GUARANTEE

A. 10-Year Warranty: Manufacturer shall supply a warranty covering the lighting system performance for 10 years from the date of final sign-off, not delivery or startup.
01 Warranty shall guarantee specified light levels.

B. Manufacturer shall maintain specifically funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover damage due to weather conditions, acts of God, accidents, misuse, misapplication, abuse, negligence, failure of owner's electrical service or unauthorized modification of any part of the product.

C. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 10 years from the date of final sign-off shipment.
01 Parts and labor shall be covered such that individual luminaire outages will be repaired when the usage of any field is materially impacted.

02 Manufacturer is responsible for removal and replacement of failed luminaires, including all parts, labor, shipping, and equipment rental associated with maintenance or warranty items.

03 Owner agrees to check fuses in the event of a luminaire outage.

D. Post-warranty maintenance shall be available on contract or call basis.

E. SCHEDULED WARRANTY ITEMS
01 Reference 260010 Closeout Requirements

3.5 SPARE PARTS AND ATTIC STOCK

A. Provide the following spare devices for each site:
01 Reference 260010 Closeout Requirements.

3.6 CLOSEOUT DOCUMENTATION

A. Upon completion of testing and certification of the system performance and operation as specified the contractor shall submit a complete set of closeout documentation in PDF format.
01 Reference 260010 Closeout Requirements.

3.7 TRAINING

A. Provide designated representatives of the Owner with complete technical training in the proper operation and maintenance of the system, at a time mutually convenient. They shall assist in the preparation of a set of detailed operating instructions for the system.

B. Provide number of hours and quantity of training sessions to Owner's general and maintenance personnel as required in specification section 260010 Closeout Requirements.

C. Provide technical support staff for the quantity of events as required in specification section 260010 Closeout Requirements.

PART 4 - DESIGN APPROVAL

4.1 SUBMITTAL REQUIREMENTS

A. Sports lighting system shop drawings shall include:

Yes / No	Item	Description
	Equipment Layout	Drawing(s) showing field layouts with pole locations
	On Field Lighting Design	Lighting design drawing(s) showing: Field Name, date, file number, prepared by Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x & y), illuminance levels at grid spacing specified Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics Height of light test meter above field surface. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), uniformity gradient (UG); number of luminaries, total system kilowatts; light loss factor.
	Photometric Report	A photometric report that shows aiming points to demonstrate the capability of the system to achieve the specified performance.
	Pole Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the State of New York.
	Foundation Drawings	Project specific foundation drawings stamped by a registered, licensed structural engineer in the State of New York. The foundation drawings must list the moment, shear (horizontal) force, and axial (vertical) force at ground level for each pole.
	Control & Monitoring System	Written definition and schematics for automated control system must be provided.
	Standard Catalog ‘Cut’ Sheets	Luminaire specification sheets

B. Lay-down and mobilization plan shall include:

01 Method to secure light poles and assemblies prior to final installation to prevent roll-over. Contractor responsible to protect equipment from theft or vandalism.

02 Lay down plan prior to any light pole deliveries. Lay down plan shall include temporary storage locations, rigging methods and delivery locations.

03 Indicate the above on an 11” x 17” drawing and include with shop drawings.

END OF SECTION 26 56 68

SECTION 28 00 10 - PHYSICAL SECURITY CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The Physical Security General Requirements as specified in Section 28, apply to the work specified in this Section.

PART 2 - MATERIALS AND METHODS

2.1 CLOSEOUT REQUIREMENTS

A. AS-BUILT DRAWINGS: Obtain a set of project drawings and keep these at jobsite during construction. During the course of construction, mark on these prints any changes which are made, noting particularly locations for those items which will need to be located for servicing. At completion of job, mark each sheet "Record Drawings", date and deliver to Architect.

B. CLOSEOUT MANUALS: At completion of job, furnish three copies of spare parts lists, operating instructions, product cutsheets, test results, manufacturer's studies/settings/reports and as-builts for all equipment furnished under this Division. These lists and instructions shall be published by the manufacturer of the equipment. Bind in 3-ring binders with project name. Provide a USB flash drive with a digital copy of complete closeout manual with each binder.

01 DOCUMENTATION:

a. Division 26:
   (i) Refer to Division 26 sections.

b. Division 27:
   (i) Refer to Division 27 sections.

c. Division 28:
   (i) Security System
      1. Owner's Operation Memo
      2. Complete device and equipment documentation.
      3. User manuals.
      4. Complete As-Built Wiring Diagrams
      5. Complete Security Device & Cabling Floor Plans
      6. Certification of system performance and operation as specified.
      7. Warranty Information
   (ii) Access Control System
      1. Owner's Operation Memo
      2. Complete device and equipment documentation.
      3. User manuals.
      4. Complete As-Built Wiring Diagrams
      5. Complete Access Control Device & Cabling Floor Plans
      6. Certification of system performance and operation as specified.
      7. Warranty Information
   (iii) Video Surveillance System
      1. Owner's Operation Memo
      2. Complete device and equipment documentation.
      3. User manuals.
      4. Complete As-Built Wiring Diagrams
      5. Complete Video Surveillance Device & Cabling Floor Plans
      6. Certification of system performance and operation as specified.
      7. Owner's Signoff of Device Aiming

8. Warranty Information

(iv) Emergency Responder Radio
1. Owner's Operation Memo
2. Complete device and equipment documentation.
3. User manuals.
4. Complete As-Built Wiring Diagrams
5. Complete Device & Cabling Floor Plans
6. Building Signal Strength Survey
7. Certification of system performance and operation as specified.
8. Warranty Information

(v) Fire Alarm System
1. Owner's Operation Memo
2. Complete device and equipment documentation.
3. User manuals.
4. Complete As-Built Wiring Diagrams
5. Complete Fire Alarm Device & Cabling Floor Plans
6. Detector Sensitivity Settings
7. Certification of system performance and operation as specified.
8. Warranty Information

02 TRAINING SESSIONS:

a. Provide digital copy of training materials and each recorded training session with digital turnover documents.

03 TESTING:

a. 281300 – Security Device Testing Report
b. 281300 – Access Control Device Testing Report
c. 281600 – Video Surveillance Device Testing Report
d. 284600 – Fire Alarm Device Testing Report

04 SPARE PARTS:

a. Deliver all spare parts and loose items to the Owner at the end of the project. Provide a spare parts list and signed transmittal listing all items with closeout documentation.

05 WARRANTY:

a. Provide manufacturer's warranty information, including any extended warranties included in the project.
b. Provide warranty letter from each contractor and sub-contractor.
c. Provide copy of extended service contracts, if any, included in the project.

2.2 GUARANTEES, WARRANTIES, AND SERVICE CONTRACTS

A. GENERAL FOR PHYSICAL SECURITY SYSTEMS: All materials, apparatus and equipment furnished and installed under this Section of these Specifications shall be new and free from any defects when accepted by the Owner and shall be guaranteed in writing for a period of one year from the date of acceptance by the Owner unless noted to have extended warranties.

B. DIVISION 26:

01 Refer to Division 26 sections for additional information.

C. DIVISION 27:

01 Refer to Division 27 sections for additional information.

D. DIVISION 28:

01 SECURITY SYSTEM

a. System (materials and installation) shall be warranted for one year following substantial completion. Problem trouble shooting and repair shall begin within 24 hours of notification.

02 ACCESS CONTROL SYSTEM

a. System (materials and installation) shall be warranted for one year following substantial completion. Problem trouble shooting and repair shall begin within 24 hours of notification.

03 VIDEO SURVEILLANCE SYSTEM

a. System (materials and installation) shall be warranted for one year following substantial completion. Problem trouble shooting and repair shall begin within 24 hours of notification.

04 EMERGENCY RESPONDER RADIO ANTENNA

a. System (materials and installation) shall be warranted for one year following substantial completion. Problem trouble shooting and repair shall begin within 24 hours of notification.

05 FIRE ALARM SYSTEM

a. System (materials and installation) shall be warranted for one year following substantial completion. Problem trouble shooting and repair shall begin within 24 hours of notification.

2.3 SPARE PARTS

A. GENERAL: Upon completion of the installation, deliver to the Owner all tools and spare parts that are furnished by the Equipment Manufacturer for use with the equipment furnished under this Contract. Include a spare parts list and signed transmittal with closeout documents.

B. Reference individual specification sections for additional information.

C. DIVISION 26:

01 Refer to Division 26 sections for additional information.

D. DIVISION 27:

01 Refer to Division 27 sections for additional information.

E. DIVISION 28:

01 SECURITY SYSTEM

a.	Wall Motion Sensors	Two (2)
b.	Ceiling Motion Sensors	Two (2)
c.	Ceiling Motion Sensors with Glass Break	Two (2)
d.	Glass Break Detectors	Five (5)
e.	Door Contacts	Three (3) of each type
f.	System Keys	Ten (10)

02 ACCESS CONTROL SYSTEM

a.	Card Readers	Two (2) of each type
b.	Video Intercom	None
c.	Video Intercom Master Station	None
d.	Door Contacts	Three (3) of each type
e.	Request to Exit Device	Two (2)
f.	Access Control Module	Two (2)
g.	Printable Cards	Fifty (50)
h.	System Keys	Ten (10)

03 VIDEO SURVEILLANCE SYSTEM

a.	Indoor Security Camera	Two (2)
b.	Exterior Fixed Security Camera	Two (2)
c.	Exterior IP PTRZ Color Camera	None
d.	Exterior Dual Sensor Camera	Two (2)
e.	Exterior 4 Sensor Camera	One (1)

	f.	Exterior 4 Sensor + PTZ Camera	None
	g.	System Keys	Ten (10)
04	EMERGENCY RESPONDER RADIO ANTENNA		
	a.	System Keys	Ten (10)
05	FIRE ALARM SYSTEM		
	a.	Ceiling Smoke Detectors	Five (5)
	b.	Ceiling Heat Detectors	Three (3)
	c.	Duct Detectors	Three (3)
	d.	Pull Stations w/ Cover	Three (3)
	e.	Monitor Module	Two (2)
	f.	Control Module	Two (2)
	g.	Strobes	Three (3)
	h.	Horn/Strobes	Three (3)
	i.	Speakers	Three (3)
	j.	Speaker/Strobes	Three (3)
	k.	Wall Strobes	Three (3)
	l.	Wall Horn/Strobes	Three (3)
	m.	Wall Speakers	Three (3)
	n.	Wall Speaker/Strobes	Three (3)
	o.	AHU Relays	Two (2)
	p.	Wireguard – Ceiling Initiation Device	Three (3)
	q.	Wireguard – Ceiling Notification Device	Three (3)
	r.	Wireguard – Wall Notification Device	Three (3)
	s.	System Keys	Ten (10)

2.4 TRAINING

A. All training sessions for specific systems equipment (Security, Access Control, Video Surveillance, Fire Alarm, etc.) shall be recorded and the recordings be included in the closeout materials.

B. Schedule the instruction in coordination with the Owner's Representative after submission and approval of formal training plans and closeout documentation.

C. DIVISION 26:

01 Refer to Division 26 sections for additional information.

D. DIVISION 27:

01 Refer to Division 27 sections for additional information.

E. DIVISION 28

01 SECURITY SYSTEM:

a. 8 Hours (2 hours to general staff and 6 hours to maintenance personnel)

02 ACCESS CONTROL SYSTEM:

a. 8 Hours (2 hours to general staff and 6 hours to maintenance personnel)

03 VIDEO SURVEILLANCE SYSTEM:

a. 8 Hours (2 hours to general staff and 6 hours to maintenance personnel)

04 EMERGENCY RESPONDER RADIO ANTENNA:

a. 6 Hours (2 hours to general staff and 4 hours to maintenance personnel)

05 FIRE ALARM SYSTEM:

a. 8 Hours (2 hours to general staff and 6 hours to maintenance personnel)

2.5 SCHEDULED WARRANTY ITEMS

A. After 10 months but no more than 11 months from Owner acceptance the contractor shall perform:

01 A warranty walk with the Owner, Owner's Representative, Architect, and Engineer and correct any identified items.

END OF SECTION 28 00 10

SECTION 28 05 44

EMERGENCY RESPONDER RADIO ANTENNA SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Division 26 apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA, NFPA and ANSI Standards and be so labeled.

E. Provide Shop Drawings, Submittals and Closeout Documents per Section 26 00 10.

1.2 RELATED WORK

A. Section 26 00 00 – General Electrical Requirements

B. Section 26 00 10 – Electrical Systems Closeout Requirements

C. Section 26 05 00 – Common Work Results for Electrical

D. Section 28 10 00 – Physical Security General Requirements.

E. Section 28 31 00 – Fire Detection and Alarm System

1.3 SCOPE OF WORK

A. Division 26:

01 Furnish and install outlets, junction boxes, conduit, connectors, wiring, and other accessories necessary to provide power and pathways for the ERRA system per the ERRA contractor's design. Requirements shall be in accordance with Division 26 00 00, Electrical.

B. Division 28:

01 Design, furnish, install, and test a complete and operating in-building Emergency Responder Radio Antenna (ERRA) System/Distributed Antenna System ['system' or 'DAS'] to provide complete coverage for the public safety agencies as required by the local fire department, other agencies and the authority having jurisdiction [AHJ]. The system will support only Emergency Responder and Public Safety Land Mobile Radios ['LMR']. The system shall not support District Radio, Cellular, and/or Wi-Fi Signals.

a. Provide a complete ERRA system for the existing high school, existing annex building, and new football field house.

b. Integrate the new ERRA system with the existing Honeywell ERRA system at the existing CTE Building and Baseball Field House.

02 Locate ERRA head end in the building main data closet. Distributed power supplies shall be located within intermediate data closets. Where necessary distributed power supplies may be located in telecom rooms with prior approval. Do not locate in other locations without prior written approval.

03 Monitor the ERRA system with the building fire alarm panel.

04 All equipment or devices requiring access for maintenance or testing shall be located in a manner to facilitate access in the future. Where items are installed above an accessible ceiling. Provide a label on the ceiling grid below identifying the system and device name as it appears on the as-built drawings and documents. Font size shall be legible from ground level below.

1.4 WORK INCLUDES

A. Provide all equipment, materials, labor, supervision and services necessary for or incidental to the installation of a complete Emergency Responder Radio Antenna System. The purpose is to extend and amplify the Emergency Responder and Public Safety Land Mobile Radio signals to a strength of 95% in all areas of the facility including elevators, stairwells and all floors.

B. It shall be the responsibility of the Emergency Responder Radio Antenna System contractor to obtain all required permits, approvals and certifications from the authorities having jurisdiction.

C. All fees associated with the licensing shall be paid by the Contractor.

D. Testing of the system shall conform to the testing requirements as described in the International Fire Code [IFC] Section 510.5.3.

E. All testing must be done on frequencies authorized by the FCC and in use by local agencies as directed by the Authority Having Jurisdiction [AHJ].

F. Final acceptance and approval shall be required from the local AHJ.

G. It shall be the responsibility of the Electrical Contractor to provide and install all conduit systems, standard electrical boxes, and operating power for the building access systems as outlined on the project drawings. This Contractor shall coordinate all system requirements with and provide special back boxes to the Electrical Contractor prior to installation of conduit.

H. The Electrical Contractor shall provide 120-volt power as required through separate dedicated branch circuits, maximum 20 amperes each. Each such circuit shall be labeled at the power distribution panel as EMERGENCY RESPONDER RADIO SYSTEM. The location of all circuit breakers serving the Emergency Responder Radio Coverage System shall be posted in the control unit cabinets. Each cabinet and all surge protection devices shall be grounded securely to the building grounding system.

01 Where the building has a standby generator, connect the ERRA system primary power source to a dedicated circuit fed from the generator.

02 Where an NEC Article 700 Life Safety power system exists, this branch of the generator power system shall be utilized.

I. Provide all testing, documentation, training, and warranty service contract as outlined in these specifications.

J. Section shall include:

01 Bi-Directional Amplifiers [BDA's]

02 Distributed Antenna System

03 Coaxial Cables

04 Splitters and Directional Couplers

05 Battery Back-Up System

06 All other equipment and components necessary for a complete and functioning Emergency Responder Radio Antenna System.

1.5 SYSTEM PRICING, PHASING AND BILLING

A. Proposed Contractor shall provide a proposal based on separate pricing for each of the following steps which shall be broken out individually within the proposal and schedule of values:

01 New Field House

a. Step #1: Outdoor Testing of the Facility – This price shall include verifying the outdoor signal strength at the facility's location prior to beginning construction.

b. Step #2: Full Testing, in accordance with IFC Section 510 Grid Testing – This price shall include verification of signal strength throughout the entire facility.

c. Step #3: Emergency Responder Radio Antenna System Materials and Installation Pricing – This price shall include a full system design and installation, including costs for design, components, materials, labor, and testing. This price shall be a "Worst-Case Scenario" situation, as though the entire facility must require coverage.

02 Existing High School and Annex Buildings

a. Step #1: Outdoor Testing of the Facility – This price shall include verifying the outdoor signal strength at the facility's location prior to beginning construction.

b. Step #2: Full Testing, in accordance with IFC Section 510 Grid Testing – This price shall include verification of signal strength throughout the entire facility.

c. Step #3: Emergency Responder Radio Antenna System Materials and Installation Pricing – This price shall include a full system design and installation, including costs for design, components, materials, labor, and testing. This price shall be a "Worst-Case Scenario" situation, as though the entire facility must require coverage.

B. The project must be budgeted as a complete set of processes, thus the reason for having all pricing, in a "Worst-Case Scenario" prior to performing any work. This pricing will provide a budget before the work begins.

C. The work will be made and billed in phases separately for each building, in accordance with the three (3) afore mentioned steps. For each building:

01 Phase I billing shall be for Step #1. Once step one is completed, results are to be provided to the General Contractor, Architect, and Engineer for review. Following this review, step two may be delayed, pending adjustment to the donor signal. If donor signal strength at the facility does not meet IFC Section 510 requirements, the AHJ must be consulted, prior to moving to step two. If the donor signal strength is adequate to meet IFC Section 510 requirements, authorization for step two will be given.

02 Phase II billing shall be for Step #2. Testing of the facility once sufficiently constructed to determine signal strength status and to provide a base for a full system design. After testing, a final revised proposal for a full system design, installation and final testing shall be issued to the General Contractor for review. No further work is authorized until award of Phase III is granted.

03 Phase III billing shall be for Step #3. Design, installation and final testing of the Emergency Responder Radio Antenna System. Provide design and final acceptance testing documents per Section 1.9 Submittals of this specification.

1.6 MANUFACTURERS

A. Prior to bidding, contractors shall contact the local authority having jurisdiction (AHJ) to confirm acceptable products.

B. Subject to compliance with requirements, available integrators offering products that may be incorporated in the work include, but are not limited to:

01 Honeywell, compatible with the existing system in the CTE Building

02 Other manufacturers allowed by the local authority having jurisdiction (AHJ) and approved by the Owner and Engineer.

1.7 CODES AND REGULATIONS

A. Perform all work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are exceeded by the contract documents.

B. The equipment, materials, and installation shall confirm to the latest version of all applicable codes, standards and regulations of authorities having jurisdiction including the following:

01 NFPA 1 – The National Fire Code (including Annex O from 2009)

02 NFPA 70 – The National Electrical Code

03 NFPA 72 – National Fire Alarm Code

04 NFPA 1221 – Standard for the Installation, Maintenance and Use of Emergency Services Communication Systems

05 UL 2524 - 1st Edition In-building 2-Way Emergency Radio Communication Enhancement Systems

06 FCC 47 CFR Private Land Mobile Radio

07 FCC 47 90.219-2007 Services-Use of Signal Boosters

08 ICC 2009 International Fire Code, Code and Commentary

09 ADA “Americans with Disabilities Act”

10 FCC’s OET 65 Standards “Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields”

11 FCC Rules Part 22, Part 90, and Part 101

1.8 DEFINITIONS

A. Attenuation: The reduction in signal power, expressed in decibels, as a result of coupling, heat loss, or transmission distance in a cable or in air.

B. Bi-Directional Amplifier [BDA]: A device used to amplify band-selective or multi-band RF signals in the uplink, to the base station for enhanced signals and improved coverage. Also known as a signal booster.

C. Coupled Bonding Conductor [CBC]: a bonding conductor placed on the outside of any technology cable. Used to suppress transient noise.

D. Delivered Audio Quality Definitions [DAQ]: The universal standard often cited in system design, specifications, and testing reports for ERRA and DAS.

01 DAQ 1: Unusable, speech present but not intelligible.

02 DAQ 2: Understandable with considerable effort. Frequent repetition required due to noise and/or distortion.

03 DAQ 3: Speech understandable with slight effort. Occasional repetition required due to noise and/or distortion.

04 DAQ 3.5: Speech understandable with repetition only rarely required. Some noise and/or distortion

05 DAQ 4: Speech easily understood. Occasional noise and/or distortion.

06 DAQ 4.5: Speech easily understood. Infrequent noise and/or distortion.

07 Speech easily understood.

E. Distributed Antenna System [DAS]: A network of service antennas connected at intervals along shielded coaxial transmission lines and all connected to head-end electronics amplifying the signals to be distributed. Often refers to a system that includes both the passive distribution system and the active amplifying electronics.

F. Directional Coupler: A component which directs a small portion of downstream RF energy to a port which can be connected to an antenna or another branch of distribution cabling, and also serves as a combiner of upstream energy between the tap port and through the connection port.

G. Donor Antenna: The antenna, usually mounted on the outside of a structure where a DAS is installed, which picks up signals over-the-air from a donor source.

H. Donor Source: The repeater, transceiver, cell site, or other radio site that produces signals which a DAS will relay and distribute.

I. Emergency Responder Radio Antenna System [ERRAS]: A two-way radio communication system installed to assure the effective operation and coverage of radio communications systems for fire, emergency medical services, and/or law enforcement agencies within a building or structure. The system is not designed for use with District LMR, Cellular Services, or Wi-Fi Services.

J. Federal Communications Commission [FCC]: federal agency responsible for implementing and enforcing America's communications laws and regulations.

K. OET 65 Standards: The FCC's Bulletin that provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.

L. Public Safety and/or First Responder: agencies which are charged with the responsibility of responding to emergency situations. These include, but are not limited to, law enforcement, fire departments, and emergency medical services.

M. Reflected Power: Power which is reflected back along a transmission line as a result of discontinuities in line impedance caused at connectors or close proximity of metallic objects.

N. Radio Frequency [RF]: Energy from electromagnetic waves, or alternating currents that produce electromagnetic waves, in the spectrum of radio frequencies (30 kHz to 300GHz)

O. Signal Booster: See BDA

P. Splitter: A passive component that has a single input port and two or more output ports, effectively splitting the signal equally amongst the output ports. It also serves to combine upstream signals from the "output" ports into composite signals at the "input" port.

1.9 SUBMITTALS

A. Submittal procedures: See Section 26 00 10 and Paragraph 1.9 Submittals of this specification.

B. Submit a complete submittal package within 30 calendar days, for approval, after award of this work. Equipment is not to be ordered without approval. Partial submittals are not acceptable for review. Each submittal shall include a dated transmittal.

C. 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.

D. Quality Assurance Submittal:

01 Letter from manufacturer stating that the Contractor is an Authorized Factory Distributor for the area where the project is located.

02 The Contractor and Manufacturer shall supply sufficient information to indicate that the proposed system is based on the latest hardware, software technology and products comply with specified requirements and FCC Regulations.

03 The system described in the submittals shall be certified by an FCC Licensed Designer and installation shall be supervised by an FCC Licensed Project or Installation Manager.

E. Product Data Submittal including special boxes, cable and other material as requested by the Architect/Engineer including:

01 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.

02 Copies of FCC Licenses for both the Designer and Project or Installation Manger.

03 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.

04 A product data index and complete equipment list including for each product submitted for approval the manufacturers name and part number including options and selections.

05 Cut-sheets or catalog data illustrating 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 for approval.

06 Shop drawings showing proposed cable routing and device locations.

a. Clearly identify any areas of exposed conduit/wiring on the drawings.

b. Devices shall be identified by part number either on the drawings or in the symbol schedule.

07 Submit design data when the scope of work requires, including passband curves for both uplink and downlink for all bands, calculations, schematics, risers, sequences or other data.

08 Any resubmittal shall include a complete revised equipment list and any product data that is revised.

09 Any rejected submittals must be corrected and resubmitted to the AHJ and Architect/Engineers within 10 days of receipt of the rejected material.

F. Submit shop drawings locating all components of the system, indicating circuit routing, cable type, and gauge, and all items or components to be installed by other trades such as 120V power requirements. 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, risers, floor plans and accurate to scale, (minimum of 1/8" = 1'-0"), equipment and device layouts prepared using a CAD or BIM engineering drawing program.

G. Testing

01 Submit all field test records of the radio systems. These shall include, but not be limited to:

a. Preconstruction Tests – Tests performed with the AHJ prior to construction of the new facility to verify that the municipality has signal coverage in that area.

b. Mid-Construction Tests – Tests performed with the AHJ during construction, once walls have been constructed and the exterior roof is installed.

c. Final Testing – Tests performed in conformance with IFC Section 510.5.3 and Section 510.6. This testing is to be signed off by the AHJ. Engineers shall also be present for the final testing process.

02 All testing records shall be submitted with O&M information and close out documents.

a. Provide one (1) digital copy of all close out documents

b. Provide three (3) copies of closeout documents bound in a 3-Ring binder with dividers and table of contents.

1.10 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 emergency responder radio coverage system manufacturer, with full warranty privileges, and shall have been actively engaged in the business of selling, installing, and servicing emergency responder radio coverage systems for a period of at least 5 years.

C. 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.

D. 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 training shall be provided with the Contractors submittal.

E. The contractor shall employ full time local technicians and installers. The manufacturer shall maintain a full-time factory employed service staff for product support and service.

F. 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.

G. All testing shall be conducted, documented and signed by a person in possession of an FCC General Radio Telephone Operators License and be a full-time employee of contractor.

H. 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. 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. Each reference project listed must utilize equipment by the same manufacturer as the proposed system.

I. 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 or license violation or has any litigation in process concerning the installation of a system is unacceptable.

J. 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.

K. The Builder shall be satisfied that a proposed Contractor meets all the requirements expressed herein before including the Contractor's proposal in the project.

L. 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.

M. 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.

N. 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. The system shall conform to the requirements as identified in IFC Section 510.4 and Section 510.5. Testing records are required to confirm performance of the system.

B. Compatibility: The equipment, including but not limited to repeaters, transmitters, receivers, signal boosters, cabling, fiber distributed antenna systems, etc., shall not interfere with the existing communication systems utilized by the Public Safety and First Responder agencies.

C. Power Supplies: At least two (2) independent and reliable power supplies shall be provided: one primary and one secondary. The primary power source shall be supplied from a dedicated 20-ampere branch circuit and comply with 4.4.1.4 of NFPA 72. The secondary power source shall be a

dedicated battery back-up, capable of operating the in-building system for at least 24 hours at 100% operation. The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in one NEMA 4 type enclosure. Monitoring the integrity of the power supplies shall be in accordance with 4.4.7.3 of NFPA 72.

01 Where the building has a standby generator, connect the ERRA system primary power source to a dedicated circuit fed from the generator.

02 Where an NEC Article 700 Life Safety power system exists, this branch of the generator power system shall be utilized.

D. Survivability

01 Fire Performance: All main risers or trunks of the antenna system shall be installed with resistance to attack from fire using one of the following methods:

02 A 2-hour fire rated cable or cable system

03 Routing the cable through a 2-hour fire rated enclosure(s) or shaft(s).

04 Cabinet: The signal booster and all associated equipment shall be housed in a single NEMA 4 certified, painted steel weather tight box. The cabinet shall be large enough to dissipate internal heat without venting from inside of the cabinet to outside atmosphere. Equipment installed on the roof of structures shall be rated for the expected extreme temperature and weather associated with rooftop installation.

E. Rooftop Installations shall require a Pitch Pocket for proper weather-tight roof penetrations.

F. Passive equipment: Passbands shall be VHF, UHF, and 700-900 MHz, IP rating of 2GHz.

2.2 SYSTEM COMPONENTS

A. Signal Strength

01 Downlink: A minimum signal strength of -95dBm shall be provided throughout the coverage area.

02 Uplink: Minimum signal strength of -95 dBm shall be received at the local municipality from the coverage area.

03 A donor antenna must maintain isolation from the distributed antenna system. The donor antenna signal level shall be a minimum of 15 dB above the distributed antenna system under all operating conditions.

B. Permissible Systems

01 Buildings and structures shall be equipped with an FCC Certified Class B Bi-Directional VHF, UHF, and 700-900 MHz amplifier(s) as needed.

02 The distributed antenna system may utilize a radiating cable, fixed antennas, or a combination of both.

C. Supported Frequencies: The system shall support VHF, UHF, and 700-900 MHz as required for local public safety and first responder bands as utilized by the local municipality.

D. Reject Filters: Notch filter sections shall be incorporated as necessary.

E. Band Migration Capability: The signal booster shall include re-tunable or replaceable filters to accommodate rapid and economic passband changes in the event of mandatory FCC changes with the NPSPAC band. The use of non-adjustable and non-replaceable RF input and output filters is prohibited.

F. Output Level Control: An automatic output leveling circuit shall be included for both passbands with a minimum dynamic range of 60 dB, less any gain reduction setting, to maintain FCC out of band and spurious emission compliance.

G. Degraded Performance in Emergencies: The system shall be designed to allow degraded performance in adverse conditions, such as abnormally high temperatures resulting from nearby fires, extreme voltage fluctuations and/or other abnormal conditions that may occur during an emergency. Circuits that intentionally disable the signal booster in such situations (i.e. under/over

voltage, over/under current, over/under temperature, etc.) shall not be implemented as the standard mode for public safety applications.

H. Mode of Operation: The system shall be normally powered on and shall continuously provide passing of frequencies within the Public Safety and First Responder bands.

I. All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.

2.3 SYSTEM MONITORING

A. The distributed antenna system shall include connections to the fire alarm system to monitor the operational integrity of the signal booster, power supplies and annunciate malfunctions on the fire alarm system. Coordinate and provide this integration, as part of this system, with the fire alarm system contractor that is authorized to service the facility's fire alarm system. The integration of the DAS with the fire alarm system shall comply with Chapter 10 of NFPA 72.

B. A sign shall be located at the fire alarm panel with the name and telephone number of the local municipality indicating that they shall be notified of any failures that extend past the 2- hour time limit.

C. A dedicated supervised monitoring panel shall be provided within the emergency command center or other location as designated by AHJ to annunciate the status of all signal booster locations. The monitoring panel shall provide visual and labeled indication of the following for each signal booster:

01 Normal AC power

02 Signal booster trouble

03 Antenna Failure

04 Loss of normal AC power

05 Failure of battery charger

06 Low battery capacity

2.4 CABLE ROUTING, INSTALLATION, AND SUPPORT

A. System wiring and equipment installation shall be in accordance with good engineering practices. Wiring shall meet all state and local electrical code requirements.

B. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.

C. Cable pathways, conduit, and cable support systems shall be complete with bushings, de- burred, cleaned, and secure prior to installation of cable.

D. Before energizing the system check all cables for correct connections and test for short circuits, ground faults, continuity, and insulation.

E. In all exposed areas such as mechanical rooms, parking garages, stairwells, etc., cable shall be fully enclosed in conduit. Exposed conduit/wiring in finished spaces shall be avoided whenever possible. Where exposed conduit/wiring is unavoidable it shall be clearly identified during the submittal phase.

F. Do not attach any supports to joist bridging or other lightweight members. The support system shall provide a protective pathway to eliminate stress that could damage the cabling.

G. Mount all equipment firmly in place such that vibration or jarring will not interfere with system operation. Route cable in a professional, neat, and orderly installation.

H. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling.

I. Cable must not be fastened to electrical conduits, mechanical ductwork or 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-feet with line voltage electrical conductors. System cables shall not be run loose on ceiling grid or ceiling tiles.

J. Provide for adequate ventilation to all equipment housings and take precautions to prevent electromagnetic or electrostatic hum.

K. All conduit, duct, track, and raceway runs shall be spaced apart to allow for maintenance, such as the installation of couplings, without disturbing adjacent pathways.

L. Each cable run shall be free of splices. No terminations, splices, or equipment will be installed in or above ceilings.

M. Do not route any communication cable within two feet of any light fixture, HVAC unit, service access area, electric panel, or any device containing a motor or transformer.

N. System cable will not be installed in the same conduit, duct, or track with line voltage electrical cable.

O. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.

PART 3 - EXECUTION

3.1 COORDINATION

A. Contractors shall coordinate with an FCC licensed engineering firm regularly employed in the business of designing and implementing Emergency Responder Radio Antenna Systems for emergency responders.

B. Electrical Work:

01 Proposed Contractor is required to provide for and coordinate with Electrical Contractor for any, and all required electrical work, including but not limited to, circuiting, conduits, back boxes, and more. The cost for all work by the Electrical Contractor shall be included in the submitted proposal for a complete and operable system.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to job site in OEM’s original unopened containers, clearly labeled with the OEM’s name and equipment model and serial identification numbers.

B. Store and protect equipment in a conditioned space until installation.

3.3 SYSTEMS INSTALLATION

A. Coaxial antenna cabling shall not be installed in the same conduit, raceway, or cable trays used for other systems.

B. All equipment shall be connected according to the OEM’s specifications to insure correct installation and system performance.

C. Coordinate all roof penetrations with General Contractor and/or Roofing Contractor.

3.4 GROUNDING

A. Ground cable shields and equipment per Manufacturer’s requirements.

B. Antenna mast shall be grounded per NFPA 70 NEC requirements and antenna manufacturer’s requirements. Provide grounding blocks and surge protection for outside coaxial cabling. Bond the antenna mast to the existing lightning protection system.

3.5 TESTING, WARRANTY SERVICE

A. A factory trained representative of the manufacturer shall supervise the final connections and testing of the system and it shall be subject to the final acceptance of the Architect/Engineer and Owner. All testing shall meet the testing standards set forth in IFC Section 510.

B. This contractor will thoroughly test all components of the systems and devices proposed herein to assure equipment specifications are met. This contractor will start up, test, and debug systems to ensure that all aspects of the system are working, documented, and reporting properly.

C. This Contractor shall make a thorough inspection and test of the complete installed Emergency Responder Radio Antenna System including all components and controls to ensure the following:

01 Complete and functional system.

02 Installed in accordance with manufacturer's instructions.

03 Verify proper operation and processing of signals.

04 Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

05 Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Contractor’s expense.

D. A final System Acceptance Test shall be performed in the presence of a designated Owner representative and the AHJ. In the event that a system does not pass or only partially passes the Acceptance Test, the Project Manager will file a discrepancy report. Corrected items will be re-tested via a punch list to ensure that they comply with the system requirements.

E. This Contractor shall provide a warranty of the installed system against defects in material or workmanship for a period of one (1) year from the date of substantial completion. Any equipment, cabling 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.

F. Immediately prior to the end of the warranty period, the system shall be inspected and certified for the following year at no additional cost to the Owner.

3.6 DRAWINGS, MANUALS, AND TRAINING

A. As-built drawings and operating and maintenance manuals 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.

B. Upon completion of the installation, and prior to final inspection, the Contractor shall furnish as-built drawings.

C. 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 calculation sheets used to configure the system.

D. Formal on-site training sessions shall be conducted by the Emergency Responder Radio Antenna System contractor. It shall be the responsibility of the Contractor to coordinate time and location of training sessions with the Owner. Provide documented general instruction as follows:

01 Provide instruction to the maintenance personnel to include the location, inspection, normal maintenance, testing, and operation of all system components. Provide a minimum of four (4) hours consisting of two 2-hour sessions separated by a minimum of two weeks.

02 Provide instruction to designated personnel on the functions and operation of the system provided including capabilities, limitations, and the meaning of status messages. State the proper procedure for testing, routine maintenance, and request for service. Provide

detailed instruction on the operation of the system. Provide a minimum of four (4) hours consisting of two 2-hour sessions separated by a minimum of two weeks.

END OF SECTION

SECTION 28 10 00 - PHYSICAL SECURITY GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SCOPE

A. Refer to Section 27 00 00 for additional project scope information.

B. This section describes the general product and execution requirements related to furnishing and installing Physical Security Systems. Physical Security Systems includes Video Surveillance, Electronic Access Control, Intrusion Detection systems and their sub systems.

C. Contractor shall be responsible for providing complete and functional systems as described in this specification and project drawings.

D. Contractor shall provide low voltage power and control lines to and from power supplies, remotely controlled equipment, and other devices, even though not explicitly indicated on drawings or listed in equipment tables.

E. Contractor shall be, or Contractor shall provide, an Electrical Contractor for provision of high voltage power and conduits/raceway, where necessary.

F. Contractor shall be responsible for any and all related programming and end-user training unless noted otherwise.

1.2 RELATED WORK

A. Section 27 00 00 – General Technology Requirements

B. Section 27 10 00 – Communications Cabling General Requirements

C. Section 27 51 00 – Campus Communications Systems

D. Section 28 13 00 – Security and Access Control System

E. Section 28 16 00 – Video Surveillance System

1.3 REFERENCE

A. In addition to any requirements below, Contractor shall abide by requirements delineated in 27 00 00 including but not limited to:

01 General: Definitions, reference standards and codes, qualifications, pre-construction submittals, construction progress submittals, closeout submittals, and correction period.

02 Products: Substitutions, product specifications, miscellaneous material, cable, connectors, power devices, and interface panels.

03 Execution: Coordination, testing, training, warranty, and cable management.

1.4 QUALIFICATIONS

A. Training: Programmer shall have received manufacturer-provided and/or manufacturer approved training in the configuration of the physical security system(s) being provided.

B. Certification: Programmer shall hold the highest applicable manufacturer programming certification(s) offered by the manufacturer(s) of the physical security system(s).

C. The installing contractor shall be licensed by the State of Texas as a security services contractor.

D. Contractor Qualifications:

01 The installing contractor shall have been actively engaged in the business of selling, installing, and servicing security alarm systems for at least five (5) years.

02 The installing contractor shall provide 24-hour, 365-days per year emergency service.

a. Maximum of 2 hour response time during normal business hours.

b. Maximum of 4 hour response time during non-business hours.

03 Register through Texas School Safety Center.

04 Pay for all applicable permits.

E. Submittal: Certification certificate shall be submitted with physical security system(s) submittals.

1.5 PRE-CONSTRUCTION SUBMITTALS

A. Contractor shall provide to Consultant the following pre-construction submittals for approval in addition to specific requirements identified in subsequent sections.

01 Qualifications: Shall include documentation of all required qualifications.

02 Shop Drawings:

a. Title: Each drawing shall have a descriptive title and all subparts of each drawing shall have unique identifiers.

b. Floor Plans: Shall include device locations, cable routing, device addresses, Contractor provided equipment, and installation notes.

c. System Drawings: Shall include functional diagrams for each system detailing system flow including all equipment, routing, inputs/outputs, system risers, wiring signal type, cable identification detail, connectors, adapters, intra/inter-rack power distribution, installation notes and any other information required to convey the complete turnkey system design.

d. Equipment Rack and Cabinet Elevations: Shall include placement of all mounted equipment.

e. Structurally Mounted Elements: Shall include both plan view of placement as well as a detail of structural mounting techniques to be used.

03 Product Data:

a. Equipment Schedules: Shall include manufacturers, part numbers, quantities, spares, and unit pricing.

b. Product Cut Sheets: Shall identify (highlight, arrow, etc.) actual part numbers to be utilized including but not limited to equipment, mounting hardware, cabling, connectors, software and power distribution equipment.

04 Manufacturer's Recommendations:

a. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, copies of these recommendations shall be provided prior to installation. Installation of the items will not be allowed to proceed until the recommendations are received and approved.

05 Hardware, Application Software, and Network Requirements: A system description including analysis and calculations used in sizing equipment required by the Physical Security Systems. The description shall show how the equipment will operate as a system to meet the performance requirements of the systems. The following information shall be supplied as a minimum:

a. Server(s) processor(s), disk space and memory size

b. Workstation(s) processor(s), disk space and memory size

c. Description of site (field) control equipment (Controllers/Field Panels) and their configuration

d. Operating System(s) Software, where software is provided or upgraded

e. Application Software, with Optional and Custom Software Modules supplied in this project

f. Integration Schemes: Proposed connectivity, software, development requirements, and SDK information, for inter-system communication.

g. Network reliability requirements

h. Number and location of LAN ports required

i. Number of IP addresses required.

j. Other specific network requirements, preferences, and constraints

k. Backup/archive system size and configuration

l. Start-up operations

m. Battery backup requirements

1.6 CLOSEOUT SUBMITTALS

A. Quick-Reference Guides: Contractor shall create a concise quick-reference guide covering normal system operation and basic troubleshooting procedures for each room/system type. Length of each quick-reference guide shall be commensurate with the information needed for successful operation, subject to Owner approval.

01 Upon Owner approval, Contractor shall provide two (2) laminated copies and one (1) digital copy for each room/system type.

B. Serial Numbers: Contractor shall provide a list of serial numbers for all supplied components with serial numbers and with a unit price greater than $99. Organize list by room/system type.

01 Reference 280010 Closeout Requirements.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Unless noted otherwise, products in this section are intended as a basis of design and are open to substitutions per the product substitution procedures defined in Section 27 0000.

2.2 REFER TO INDIVIDUAL SECTIONS.

PART 3 - EXECUTION

3.1 TRAINING

A. On-Site Training

01 General: Present, review and describe equipment and materials to the Owner and Owner's operating personnel and fully demonstrate the operation and maintenance of the systems, equipment and devices specified herein.

02 Include with new systems, Contractor to arrange and provide for video recording of each onsite training session.

a. Provide professional video and audio recording of each software screen option with Owner approval of content.

b. Provide end user video recording for Department of Safety & Security approved processes.

c. Provide Security Systems Specialists approved recording of maintenance and troubleshooting process.

03 Training shall comprise two separate levels of training;

a. User Group upon substantial completion of the project.

1) User group training shall include a site/building walk through indicating locations of equipment and their usage.

2) User group training shall include the operation of workstation capability of system monitoring, command override and report generation.

b. Maintenance Group upon completion of the project prior to close out.

1) Maintenance group training shall include a site/building walk through indicating locations of equipment and their usage at up to six representative sites.

2) Review of a-build documentation at each controller location.

3) Troubleshooting techniques in hardware and software.

04 The training shall cover the overall system, each individual system, each subsystem, and each component. The training shall also cover procedures for database management, normal operations, and failure modes with response procedures for each failure. Each procedural item shall be applied to each equipment level.

05 Training shall include a “user’s manual” written for the school personnel on-site in the operation of the system.

B. Duration: Refer to the individual sections for the minimum time requirements.

3.2 WARRANTY

A. Furnish and guarantee maintenance, repair and inspection service for the system using factory trained authorized representatives of the manufacturer of the equipment for a period of one year after final acceptance of the installation.

B. Third Party Device warranties are transferred from the manufacturer to the Contractor, which may then transfer third party warranties to the Owner. Specific third party warranty details, terms and conditions, remedies and procedures, are either expressly stated on, or packaged with, or accompany such products. The warranty period may vary from product to product. These products include but are not limited to devices that are directly interconnected to the field hardware or computers and are purchased directly from the manufacturer.

C. Purpose

01 The Contractor shall repair any system malfunction or installation deficiency discovered by the Owner or their representatives during the burn in and warranty period.

02 The Contractor shall correct any installation deficiencies found against the contract drawings and specifications discovered by the Owner or their representatives during the warranty period.

3.3 EXAMINATION OF SITE AND DOCUMENTS

A. Bidder shall examine all documents, shall visit the site(s) prior to submitting proposal, record their own investigations, and shall inform themselves of all conditions under which the Work is to be performed at the site(s) of the Work, including the structure of the ground, the obstacles that may be encountered, and all of the conditions of the documents, including superintendence of the Work, requirements of temporary environmental controls, the time of completion, list of Subcontractors, and all other relevant matters that may affect the Work or the proposal process.

B. Verify cable lengths comply with published standards.

C. Notify Owner/Consultant of installation that would exceed maximum lengths prior to installation of

cable.

D. Contactor shall consult with Owner/Consultant regarding alternative routing or location of cable.

E. Do not proceed until unsatisfactory conditions have been corrected.

F. Failure to make the examination shall not result in any Change Order requests.

G. The Bidder shall base the proposal on the site(s) examination, materials complying with the plans and specifications and shall list all materials where the proposal form requires.

H. The commencement of work by the Contractor shall indicate acceptance of existing conditions, unless a written notice of exceptions has been provided to the Owner/Consultant prior to commencement.

I. If the Contractor observes, during preliminary examinations or subsequent work, existing violations of fire stopping, electrical wiring, grounding, or other safety- or code-related issues, the Contractor shall report these to the Owner/Consultant in a timely manner.

3.4 SPARE PARTS AND ATTIC STOCK:

A. Provide the following spare devices for each site:

01 Suggested List: Contractor is requested to submit a list of suggested spare parts with an offered price, allowing Owner to select appropriate parts.

02 Means of Obtainment: Contractor shall state where spare parts can be obtained after the installation.

03 Keys: Contractor shall turnover all keys, tagged and organized by type on individual key rings, to Owner upon project completion.

04 Refer to individual sections and section 280010 Closeout Requirements

B. Each sub-contractor shall include in his bid the cost to provide and install the additional spare parts and associated wiring as directed by the Owner/engineer. All devices not used during construction shall be turned over to the Owner at the time of job completion.

3.5 INSTALLATION REQUIREMENTS

A. Contractor shall furnish and install all cables, connectors, and equipment as shown on Drawings and as specified herein.

B. It is the Contractor’s responsibility to survey the site and include all necessary costs to perform the installation as specified. This includes any modifications required to route and conceal horizontal distribution wiring.

C. Beginning installation means Contractor accepts existing conditions.

D. Contractor shall furnish all required installation tools to facilitate cable pulling without damage to the cable jacket. Such equipment shall include, but not be limited to, sheaves, winches, cable reels, cable reel jacks, duct entrance tunnels, pulling tension gauge, and similar devices. All equipment shall be of substantial construction to allow steady progress once pulling has begun. Makeshift devices that may move or wear in a manner to pose a hazard to the cable shall not be used.

E. All cable shall be pulled by hand unless installation conditions require mechanical assistance. Where mechanical assistance is used, care shall be taken to ensure that the maximum tensile load for the cable as defined by the manufacturer is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of a “break-away,” or other approved method.

F. The Contractor shall be responsible for identifying and reporting to the General Contractor any existing damage to walls, flooring, tiles, and furnishings in the work area prior to start of work. All damage to interior spaces caused by the installation of cable, raceway, or other hardware shall be repaired by the Contractor.

G. Repairs shall match preexisting color and finish of walls, floors, and ceilings. Any Contractor-damaged ceiling tiles, floor, and carpet shall to be replaced to match color, size, style, and texture.

H. Where unacceptable conditions are found, the Contractor shall bring this to the attention of the

construction supervisor immediately. A written resolution will follow to determine the appropriate action to be taken.

I. Qualified personnel utilizing state-of-the-art equipment and techniques shall complete all installation work. During pulling operation, an adequate number of workers shall be present to allow cable observation at all points of duct entry and exit as well as to feed cable and operate pulling machinery.

J. Cable pulling shall be done in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards. Manufacturer's recommendations shall be a part of the cable submittal. Recommended pulling tensions and pulling bending radius shall not be exceeded. Any cable bent or kinked to radius less than recommended dimension shall not be installed.

K. All wiring shall be run "free-air," in conduit, in a secured plastic raceway or in modular furniture as designated on the Drawings. All cable shall be free of tension at both ends. PLENUM rated cable shall be used in areas used for air handling.

L. Avoid abrasion and other damage to cables during installation.

M. Pulling lubricant may be used to ease pulling tensions. Lubricant shall be of a type that is non-injurious to the cable jacket and other materials used. Lubricant shall not harden or become adhesive with age.

N. The cable system will be tested and documented upon completion of the installation as defined in the section below.

O. A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit or surface mount raceway. Should it be found by the Consultant that the materials or any portion thereof furnished and installed under this contract fail to comply with the specifications and Drawings with the respect or regard to the quality, amount of value of materials, appliances, or labor used in the work, it shall be rejected, removed, and replaced by the Contractor and all work distributed by changes necessitated in consequence of said defects or imperfections shall be corrected at the Contractor's expense.

P. All manufactured items, materials, and equipment shall be applied, installed, connected, erected, used, and adjusted as recommended by manufacturers or as indicated in their published literature, unless specifically noted herein to the contrary.

3.6 COOPERATION

A. The Contractor shall cooperate with Consultant's and Owner's personnel in locating work in a proper manner.

B. Should it be necessary to raise, lower, or move longitudinally any part of the work to better fit the general installation, such work shall be done at no extra cost to the Owner, provided such decision is reached prior to actual installation. The Contractor shall check location of electrical outlets with respect to other installations before installing.

3.7 COMMISSIONING SUBMITTALS

A. Provide the following to the Owner no later than 30 days prior to system commissioning/programming.

01 Commissioning Test Plan and Check-Off List: Specified elsewhere in this document.

02 Software: One set of fully functional software in manufacturer's original media packaging, temporarily licensed for a 30-day evaluation period.

03 Web-based Training: Access to web-based training modules.

3.8 COMMISSIONING

A. Provide programming and commissioning for each system as described in individual sections below.

B. This Contractor shall develop and submit a plan for coordination of settings and programming issues with the Consultant and Owner no later than 30 days prior to performing programming and

commissioning.

C. The security Contractor is required to place entire system into full and proper operation as designed and specified.

D. Verify that all hardware components are properly installed, connected, communicating, and operating correctly.

E. Verify that all system software is installed, configured, and complies with specified functional requirements.

F. Perform final acceptance testing in the presence of Owner's representative, executing a point-by-point inspection against a documented test plan that demonstrates compliance with system requirements as designed and specified.

01 Submit documented test plan to Owner at least 14 days in advance of acceptance test, inspection, and check-off.

02 Conduct final acceptance tests in presence of Owner's representative, verifying that each device point and sequence is operating correctly and properly reporting back to control panel and control center.

03 Acceptance by Owner is contingent on successful completion of check-off; if check-off is not completed due to additional work required, re-schedule and perform complete check- off until complete in one pass, unless portions of system can be verified as not adversely affected by additional work.

04 The system shall not be considered accepted until all acceptance test items have been successfully checked-off. Beneficial use of part or all of the system shall not be considered as acceptance.

3.9 OPERATION AND MAINTENANCE MANUALS

A. Part One: Notwithstanding requirements specified elsewhere, submit the following labeled as the "Operating and Maintenance Manual" within thirty (30) days after Final Acceptance of the Installation:

01 Record Drawings: Submit two (2) copies of revised versions of drawings as submitted in the "Shop and Field" and "Equipment Wiring Diagrams" Submittals showing actual device locations, conduit routing, wiring and relationships as they were constructed. Include nomenclature showing as-built wire designations and colors. Drawings shall include room numbers coinciding with Owner space planning numbering. Drawings shall be submitted in electronic editable AutoCAD 2010 files, in ".dwg" format, on CD or DVD disks.

02 Manuals: Submit two (2) copies of each of the following materials in bound manuals, or electronic PDF copies, with labeled dividers:

a. A final Bill of Material for each system

b. Equipment Instruction Manuals: Complete, project specific comprehensive instructions for the operation of devices and equipment provided as part of this work.

c. Manufacturers Instruction Manuals: Specification sheets, brochures, Operation Manuals and service sheets published by the manufacturers of the components, devices and equipment provided.

d. Include information for testing, repair, troubleshooting, assembly, disassembly and recommended maintenance intervals.

e. Provide a replacement parts list with current prices. Include list of recommended spare parts, tools, and instruments for testing and maintenance purpose.

f. Performance, Test and Adjustment Data: Comprehensive documentation of performance verification according to parameters specified herein.

g. Warranties: Provide an executed copy of the Warranty Agreement and copies of all manufacturer's Warranty Registration papers as described herein.

B. Part Two: Within fourteen (14) days of receipt of Consultant reviewed Operating and Maintenance Manual (Phase One), submit three (3) electronic copies in AutoCAD 2010 editable .dwg format of the

reviewed Record Drawings and three (3) copies of the reviewed Operating and Maintenance Manuals to the Owner, on CD or DVD disks.

01 Within each equipment enclosure and/or terminal cabinet, the Contractor shall place a Single Line drawing of the system(s) and the respective Terminal Cabinet Wiring Diagram in a clear plastic sleeve permanently attached to the inside cover of the terminal cabinet.

02 In each equipment enclosure the Contractor shall place a drawing providing device locations served by the equipment within the enclosure with identification that is identical to the wiring tags and with the software description of each point.

03 The Contractor shall provide to the Owner one (1) copy of new administration and user software, including required graphical maps, on CD or DVD disks.

C. Sufficient information, (detailed schematics of subsystems, assemblies and subassemblies to component level) clearly presented, shall be included to determine compliance with drawings and specifications.

01 Drawings shall include model number, serial number and installed location for major equipment including all CCTV cameras.

3.10 CLOSEOUT PROCEDURES

A. Notification: Contractor shall provide written notification to Architect/Consultant and Owner when Contractor is satisfied that the work has been completed and is ready for inspection.

B. Closeout Submittals: Contractor shall provide closeout documentation to the Architect/Consultant. The Architect/Consultant shall receive the closeout submittals no less than 72 hours prior to the scheduled inspection time.

C. Inspection: Contractor shall be present for the inspection by the Architect/Consultant. Contractor shall supply all testing equipment needed to verify compliance with the specifications found in Bid package.

D. Punch List: Work or materials found to be incomplete, of unsatisfactory quality, failing to meet the specifications in the Bid package, and/or unacceptable to the Architect/Consultant shall be documented by the Architect/Consultant and provided to Contractor to rectify.

E. Re-Inspection: If a re-inspection is necessary, the costs of the Architect/Consultant's additional travel, hours, and expenses may be deducted by the Owner from the contract amount due Contractor.

F. Punch List Approval: The punch list shall be considered complete only after having been signed by the Owner and Architect/Consultant.

G. The system has successfully completed a 30-day performance period.

H. Payment Authorization: Final payment will be authorized only after all closeout procedures and requirements have been followed and fulfilled by Contractor and approved in writing by the Owner and Architect/Consultant, including punch list(s) and/or re-inspection(s).

3.11 SERVICE CONTRACT

A. The service contract shall cover equipment and software related to this contract, and shall provide for the following parts and services, without additional cost to the Owner:

01 Bi-yearly inspections, preventative maintenance and testing of equipment and components in Year One of the warranty period.

02 Annual inspections, preventive maintenance, and testing of equipment and components in Years Two and above of the warranty period.

03 Regular Service, Emergency Service, and Call-Back Service

04 Labor and Repairs

05 Equipment, and Materials and transportation cost.

B. Response Time: Response time for service calls.

01 Emergency service calls where system is not responding to staff directed commands through the computer systems shall be within 2 hours to the project site.

02 Emergency service calls where controllers are not reporting shall be within 2 hours to the project site.

03 Normal service calls for device malfunctions shall be within 24 hours during normal working hours to the site.

C. Repair Time: Contractor shall stock parts in sufficient quantities such that repair or replacement shall be guaranteed within 12-hours. Temporary replacements within this time period shall be acceptable, provided temporary replacements do not compromise system functionality, and provided permanent replacement is achieved within 72 hours. Contractor may contact Owner representative for use of Owner supplied spare parts where delay of system repair will have negative impact on system performance.

D. Commencement: The warranty begins at the time of issuance of the statement of "Final Acceptance of the Installation" by the Owner.

E. Transferability: The warranty shall be transferable to any person or persons at the discretion of the Owner.

F. Transmittal: A copy of this Warranty shall be delivered to, and signed for by the Owner's representative whose primary responsibility is the operation and care of these systems. A copy of the signed Warranty document shall be delivered for review as part of the Final Submittals.

G. Registration: Register Warranty papers for all equipment and software in the name of the Owner. Furnish reproductions of all equipment Warranty papers to the Owner with the Final Submittals.

H. Subcontracting: Warranty service work may not be subcontracted except with specific permission and approval by the Owner.

I. Resolution of Conflicts

01 The Owner retains the right to resolve unsatisfactory warranty service performance at any time by declaring the work unsatisfactory, stating specific areas of dissatisfaction in writing.

02 If the Contractor or his approved Subcontractor does not resolve such stated areas of dissatisfaction within thirty (30) days, the Owner may appoint any alternative service agency or person to fulfill the terms of the Warranty; the cost of which shall be borne by the Contractor. This action may be taken repeatedly until the Owner is satisfied that Warranty service performance is satisfactory. Satisfactory resolution of a malfunction shall be considered adequate when the device, equipment, system or component which is chronically malfunctioning is brought into compliance with the standards of performance as contained herein and published by the manufacturers of the equipment installed.

END OF SECTION 28 10 00

SECTION 28 46 00

FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General, Supplementary and Special Conditions, apply to the work specified in this Section.

B. The General Electrical Requirements as specified in Sections 26, apply to the work specified in this Section.

C. Equipment shall meet or follow applicable requirements in other sections of the specifications and on the drawings.

D. Equipment shall meet applicable requirements include in the NEC, UL, NEMA, NFPA and ANSI Standards and be so labeled.

E. Provide Shop Drawings, Submittals and Closeout Documents per Section 26 00 00.

1.2 RELATED WORK

A. Division 8 – Openings

B. Division 21 – Fire Sprinkler System

C. Section 26 00 00 – General Electrical Requirements

D. Section 26 00 10 – Closeout Requirements

E. Section 26 05 00 – Common Work Results for Electrical

F. Section 26 09 43 – Lighting Controls

G. Section 26 24 00 – Switchboards and Panelboards

H. Division 27 – Communications Systems

I. Division 28 – Security Systems

J. Division 28 – Emergency Responder Radio Antenna

PART 2 - MATERIALS AND METHODS

2.1 GENERAL

A. Design, furnish and install a complete fire alarm system based on a fire alarm panel utilizing addressable architecture with analog intelligent devices as specified herein and shown on the drawings. Equipment shall be manufactured by Edwards/EST or Notifier. Installation shall be in accordance with the manufacturer's recommendations. The system shall conform to the most recent issue of the applicable NFPA Sections, the National Electric Code and applicable local codes for fire detection/alarm requirements. This also includes the State of Texas requirements for school facilities.

01 There is an existing Edwards EST3 system located in the administration area of the existing high school. Expand existing system and extend to the new football field house.

B. Note that the complete fire alarm system shall be designed by the fire alarm contractor’s licensed designer per all applicable codes. In the event that certain devices are shown on the drawings that may be in excess of the minimum code standards, incorporate these additional requirements into the contractor’s design since the Owner’s requirements are in addition to the minimum code

requirements. Devices are shown to indicate the areas of coverage and to provide a means for the electrical contractor to estimate raceway requirements, and to assist in coordinating with architectural constraints. Fire alarm contractor shall produce his own signed, sealed and certified drawings based on his design for submission to the governmental authorities.

C. The following are suggested suppliers of the specified equipment and are provided for reference based on previous experience with these firms.

01 EST/Edwards Wilson Fire, CLS Technology

D. The system shall consist of all fire alarm panels, manual pull stations, automatic detectors, visual and audible alarm devices and accessory equipment as described in the specifications and/or indicated on the drawings. All components of the system shall be standard products of the manufacturer, approved by Factory Mutual and Underwriters' Laboratories, Inc. Provide Ditek surge suppression protector on 120 volt power connections, telephone connections and for system circuits that extend between buildings.

E. Where detection and alarm devices are shown on the drawings they indicate areas for detection and alarm coverage and not the exact number and placement of devices. Provide devices in sufficient number and locate to protect and alarm the specified areas in accordance with the NFPA, these specifications and the limitations of the devices provided.

F. Under this Division, engage the services of a fire alarm company who is an authorized distributor for an approved fire alarm system (as indicated below) who shall:

01 Be local to the Houston area.

02 Installer shall provide 24-hour 365-day per year emergency service and support

03 Be properly licensed to perform the work by the State of Texas.

04 Maintain a staff of specialists for engineering assistance, installation and maintenance of the fire alarm system and associated equipment.

05 Stock the required spare parts to keep the fire alarm system in operation.

06 Have proof of experience in the installation and maintenance of the type of fire alarm system specified herein.

G. After installation and prior to the final inspection, the Contractor must certify in a letter to the Owner that the system is working in accordance with the Contract Documents.

H. Provide an adequate period of instruction on the operation of the system to the Owner's designated personnel upon completion of the system installation.

I. Provide the Owner with the following:

01 Two composite wiring diagrams of the system indicating point to point connections, one to be placed in the control panel.

02 Two block diagrams of the system indicating conduit and number and size of wires between all devices, one to be placed in the control panel.

03 One bound copy of the complete instructional/operational maintenance manual including as-built drawings, test reports, calculations, etc. to be placed in the control panel.

04 Floor plan of building noting zoning, pull station and detector locations, acceptable to the Fire Marshall. Provide frame and install where directed by the Fire Marshall.

05 All necessary signage as required by locally adopted codes and authorities having jurisdiction. Provide signage and install where required and/or directed by the Fire Marshall.

J. Contractor shall have a representative at the job site during the final inspection by the Engineer to demonstrate system operation and specification compliance. Representative will be required to "smoke test" a number of randomly selected active devices.

2.2 SYSTEM LAYOUT

A. Device layout shown on the Drawings shows areas of coverage and to assist the electrical contractor in estimating junction box requirements during bidding. Fire alarm supplier shall properly design a system based on his equipment and devices that meets ADA, NFPA and Texas Accessibility requirements and these specifications.

B. Provide sound and visual alarm coverage of the building.

C. Provide pull stations at the main panel, remote annunciators, local operators cabinets, and additionally as indicated on the drawings.

D. Provide smoke detector coverage of all halls and corridors, storage rooms, Central Mechanical Room, each AHU Room, each electrical room and additionally as indicated on the drawings.

E. Provide smoke duct detector in the return air or supply air of each air handling unit. Where return air is not ducted, provide photoelectric coverage of return air openings in the room. Provide smoke duct detector in each fan powered VAV box 2000 CFM or larger.

F. Provide heat detector coverage of all unconditioned occupied spaces, custodial rooms, Central Mechanical Room, each AHU Room, each electrical room and additionally as indicated on the drawings.

G. Main communications and local sound reinforcement systems in the weight room, collaboration space, and classroom projector/audio video speakers shall be automatically muted during the fire alarm system activation to meet audibility requirements. (NFPA Life Safety Code 101, 9.6.3.8, 9.6.3.10.2(3) and National Fire Alarm Code 72, 18.4.4.5, 24.5.13, 24.5.25). However, the school communication system shall remain capable of manual override so that the school staff can deliver voice instructions over the school communications system, such as directing students to return after a fire drill. The General Contractor shall coordinate with all relevant contractors (fire alarm, communications system, audio video, etc.) for this requirement during the bidding period. Include the cost for all cabling, relays, modules, etc. as required to meet these requirements.

H. The fire alarm panel shall monitor the Emergency Responder Radio Antenna System

I. The fire alarm system shall be integrated with security to provide remote monitoring service.

J. Building is fire sprinkled.

01 Interlock alarm with fire sprinkler system and monitor position of O S & Y valves and Post Indicator Valve. Provide individual address for each valve sensor and flow switch.

02 Coordinate with Division 26 to provide a conduit from the building to the fire sprinkler vault.

K. Refer to Drawings for additional information.

2.3 SYSTEM OPERATION

A. Actuation of any alarm initiating device shall cause the following:

01 An LCD readout on the main control panel shall indicate the device in alarm.

02 Alarm tones shall sound throughout the facility. Upon expiration of the alert tone, a digitized predetermined voice evacuation message shall be automatically transmitted throughout the facility via evacuation speakers. The system shall have the capability to generate multiple distinct digital messages as determined by event initiated programs.

03 All sounder/flasher alarms shall sound continuously until reset at main panel.

04 De-energize air handling units serving the area in alarm. Also de-energize supply fans, fan powered boxes, VAV boxes, ERV, HVLS fans and other air circulating devices if 2000 CFM or over, serving the area in alarm. Exhaust fans to the exterior and devices less than 2000 CFM are not required to be controlled.

a. De-energize all high volume low speed (HVLS) fans.

05 Release fire doors and smoke dampers.

06 Transmit alarm warning to remote location via network-based IP communicator. Alarm communication shall send individual point information to the central receiving station.

B. The actuation of automatic detection devices shall be visually identified by light on device. The light shall remain illuminated until the initiating device has been restored to normal and the Fire Alarm Panel reset. A remote alarm lamp shall light where indicated on drawings.

2.4 SYSTEM PANEL

A. GENERAL: All equipment shall be manufactured by the same company as the control panel or be a factory authorized compatible device. Devices that may operate but are not factory authorized compatible shall not be used. This includes remote power supplies, horns and strobes. Devices shall be WHITE in color where that option is available. In existing buildings, communication between the fire alarm control panel and remote devices shall use the existing protocol.

B. CONTROL PANEL: The control panel shall be a microprocessor based, addressable intelligent system enclosed in a semi-flush style cabinet or equal by the approved manufacturers. The door and frame assembly shall be equipped with a lock and transparent door panel for viewing of indicators of operation and annunciation. The control panel shall contain, but not be limited to the following:

01 Control modules as required to provide system monitoring, alarm control, trouble sensing and remote equipment control.

02 City/remote station module to service as interface unit between the fire alarm control panel and an authorized remote monitoring point.

03 Power supply modules as required to supply continuous filtered power of the proper voltage. Module shall indicate a normal power, battery trouble and power supply trouble, all readable on front of the enclosure. System shall also meet additional spare capacity requirements below.

04 Sealed and rechargeable battery supply, sized for 24 hour sensing and 15 minute alarm capability. System shall also meet additional spare capacity requirements below.

05 Remote alarm signal distributing panels with power supplies as needed by final design of the fire alarm contractor. Remote power supplies shall be located in telecom rooms. Do not install in storage rooms or finished spaces.

06 System shall be selected based on the system installed plus 25% additional detection devices for future expansion.

07 All power supplies, amplifiers and battery supplies shall be sized based on the system installed plus 50% additional alarm devices. For example, no more than 4A shall be allocated on a 6A power supply or 50W on a 75W amplifier to provide spare capacity for future growth. Power supply, amplifier and battery calculations must be submitted for engineer review. Electrical Contractor shall provide and install 120 VAC to each remote power supply.

2.5 VOICE COMMUNICATIONS

A. The voice communications panel shall be modular in design utilizing solid state microprocessor circuitry. The voice evacuation system shall integrate with the main fire alarm control panel. Side car voice evacuation systems are not acceptable.

B. Communications Controls: The communications control panel shall incorporate the following controls and indicators:

01 All call

02 General alarm

03 Audio trouble LED

04 Audio level LED

05 Manual tone/MESSAGE select switches with LED indicators

06 Communications zone select switches and select indicators

07 Communications monitor speaker with volume control

08 Dynamic paging microphone

C. Paging

01 The microprocessor based one-way paging system shall be provided with a means to selectively activate voice, tones or digitized messages to any or all zones in the system via electronic membrane touch-pad controls. In addition, visual indication by zone will be provided.

02 Each audio/speaker circuit will be totally supervised for opens, shorts or grounds with direct shorts prohibiting selection of the respective zone. All audio circuits shall be power limited. Each speaker zone shall be provided with an amber trouble LED for circuit trouble conditions and an active/on LED indicator.

03 Alarm/Paging zones shall be provided as required.

04 Provide combination supervised remote microphone and annunciator for the voice evacuation system at each remote annunciator location meeting the UL requirements for a Local Operator's Console (LOC).

D. Alarm Electronics

01 The voice communications center shall be a microprocessor based, supervised, multi-function, audio generator. The communications generator shall contain:

a. Independent Voice communications CPU.

b. Nonvolatile RAM memory.

c. One custom digitized message circuits.

d. Up to four selectable tone generator/oscillators.

e. Each sub circuit of the communications center shall be fully supervised and failure of any tone oscillator or digital message generator shall revert the system to the default standby generator.

02 The system shall be provided with a custom field programmable digitized message.

03 The system shall provide adequate audio amplification. The system shall be capable of amplifier capacity and expansion as required. Each amplifier shall be continuously monitored electronically for proper output level. Each unit shall be equipped with diagnostic indicators. Each amplifier shall provide a minimum of 50 watts of 25 VRMS of power. Each unit shall be equipped with its own individual power/pilot LED, audio input trouble LED, battery input trouble LED, and amplifier trouble/fail LED. Provide amplification for 1/2 watt per speaker plus 33% spare capacity. Electrical Contractor shall provide and install 120 VAC to each remote amplifier cabinet (if needed).

2.6 REMOTE EQUIPMENT

A. MANUAL PULL STATIONS: Addressable type, red Lexan, non-coded, dual action type.

01 Provide Stopper II cover with battery powered sounder over all pull stations except those located at the main panel and remote annunciators.

B. AREA SMOKE DETECTORS: White, analog addressable, photoelectric type, non-polarized with 360° smoke entry, LED normal/alarm status light and separable base.

C. DUCT DETECTORS: Analog addressable, photoelectric type with DPST auxiliary relay. Provide LED remote alarm light with engraved stainless steel plate on ceiling near detector where detectors are not located in mechanical rooms.

01 Provide a duct smoke detector located within 5 feet of each smoke or fire/smoke damper. Reference mechanical drawings for locations.

02 For duct detector testing, provide a manufacturer compliant, keyed, test box that shall be installed for duct detectors that are not easily accessible from a 6' ladder. These shall be

mounted on wall or unit (if permissible) at a height of no more than 6' above finished floor.

D. HEAT DETECTORS: White, analog addressable. Heat detectors shall be rate of rise type except in kitchen spaces which shall be 135°F fixed temperature.

E. COMBINATION DETECTORS:

01 Where smoke and heat detectors are shown together they may be combined into a single device meeting all requirements and functionality were they to be provided separately.

F. SPEAKERS AND SPEAKER STROBES: White, semi-flush, ADA compatible, electronic speakers with high visibility, synchronized strobe and field selectable volume. Set volume level based on individual application (hall, classroom, restroom, office, etc.) Audible portion shall comply with audibility and intelligibility standards as required by NFPA. Strobe intensity shall conform to NFPA Chapter 6 requirements and also 75 candela to meet ADA and TAS requirements.

G. STROBE LIGHTS: White, semi-flush, ADA compatible, synchronized strobe with intensity suitable for the individual application (hall, classroom, restroom, office, etc.). Strobe intensity shall conform to NFPA 1993 Chapter 6 requirements and also 75 candela to meet ADA and TAS requirements.

H. FIRE SPRINKLER SYSTEM ALARM BELL: Bells shall have underdome strikers and operating mechanisms. Gongs on said bells shall be no smaller than nominal 6″ with an operating voltage of 24VDC. Bells shall be suitable for surface or semi-flush mounting. Outdoor surface mounted installations shall be weatherproof using weatherproof backbox. Otherwise bells shall mount to a standard 4″ square electrical box having a maximum projection of 2½″. Bells shall be located on the exterior wall outside the fire sprinkler riser room or as determined by the Authority Having Jurisdiction. Bells shall be listed for indoor/outdoor use by Underwriters Laboratories and approved by Factory Mutual and MEA.

I. DIGITAL COMMUNICATOR: Network-based IP communicator.

J. RELAYS: Provide and install control relays to perform the specified functions. This includes relays to shut down the various HVAC equipment. Relays shall be mounted near items to be controlled. Coordinate with HVAC controls contractor for relay contact voltage capability (120 volts minimum) and preferred mounting location.

K. WEATHERPROOF: Devices located outside, even if sheltered from rain shall be weatherproof and suitable for outdoor installation.

L. PROTECTIVE GUARDS: Provide Stopper Type Lexan protective guards on devices located in communal bathrooms, locker rooms, weight rooms, and in additional areas noted on the Drawings.

M. REMOTE STROBE CONTROLLER: Provide local controller as necessary to power and synchronize flash for strobe devices.

N. REMOTE ANNUNCIATOR / LOCAL OPERATOR CONSOLE: Provide combination supervised remote microphone and annunciator for the voice evacuation system at each remote annunciator location meeting the UL requirements for a Local Operator's Console (LOC). Remote paging microphone shall be installed in recessed cabinet. Remote paging microphone type and operation shall match the one provided at the main system panel. Coordinate desired all-call and selective paging settings with Owner.

O. REMOTE PAGING MICROPHONE: Provide remote paging microphone in recessed cabinet at each remote annunciator location. Remote paging microphone shall match the one provided at the main system panel. Coordinate desired all-call and selective paging settings with Owner.

P. SURGE SUPPRESSOR: Provide surge suppressor for each fire alarm panel, remote power supplies, amplifiers, expansion panels, etc. Note surge suppression unit must be a minimum of three feet from the panel.

01 Fire Alarm Control Panels:

a. Total surge protection solution in NEMA 1 enclosure with 120V surge protection and up to ten pairs of SLC, IDC/PIV, NAC, or dialer circuits. Install above ceiling at fire alarm panel where installed in finished spaces or adjacent to panel where installed in building equipment spaces.

b. Fire alarm panel shall monitor the 120 volt suppressor dry contact so panel will go into failure if the suppressor is inoperable.

c. Provide breaker lockout kit on 120V circuit serving fire alarm panel.

d. Basis of design: Ditek DTK-TSS1 w/ DTK-2MHLP

02 Fire Alarm Power Supplies, Amplifiers, Expansion Panels, and miscellaneous 120V circuits.

a. Provide surge suppression protection on all 120 volt power connections serving fire alarm circuits.

b. Provide breaker lockout kit on all 120V fire alarm circuits.

c. Basis of design: Ditek DTK-120HWLOK

03 Fire Alarm Low Voltage Systems:

a. Provide surge suppression protection for system low voltage circuits (including telephone circuits) that extend to the exterior of the building or between buildings.

04 Approved Equipment

a. Ditek DTK-TSS1

b. Ditek DTK-120SRD

c. Ditek DTK-120S1

d. Ditek 2MHLPB Series

e. Ditek MRJ Series

f. Ditek DTK-2LVLPF

g. Ditek DTK-120HWLOK

h. Or equal with prior written approval.

Q. SPECIAL EQUIPMENT LABELING AND DEVICES

01 Coordinate with electrician to provide red circuit lockout device on all circuit breakers serving fire alarm equipment and devices. Provide additional lockout devices for any circuits added per the fire alarm contractor's design for power supplies, amplifiers, etc.

a. Space Age Electronics ELOCK-FA E-Series Lockout Kit, lockout kit provided with Ditek DTK-120HWLOK, or equal with written approval.

b. Confirm kit is compatible with provided electrical gear prior to ordering.

02 Electrical Equipment Field Nameplates:

a. Provide typewritten label with white letters on a contrasting red background reading "FA" permanently attached to the panel dead front adjacent to each breaker.

b. Provide typewritten label with white letters on a contrasting red background permanently attached to the outside of the panel cover reading 'FIRE ALARM CIRCUIT INSIDE" or similar.

03 Fire Alarm Equipment Field Nameplate:

a. Provide 2.25" x 4" lamacoid master nameplate for each fire alarm panel, power supply, amplifier, expander panel, or similar equipment with ½" high engraved letters for equipment name and ¼" high letters for system circuit information and mounting holes.

1) In unfinished spaces attach nameplate with mastic and two screws to panel front cover.

2) In finished spaces attach nameplate with mastic to inside of panel front cover.

b. Coordinate with Division 26 to give same circuit name and number as shown on panelboard schedule.

R. DOCUMENT CABINET

01 Provide a wall mounted document cabinet, factory finished in red enamel, with all required documents inside. Cabinet shall incorporate an integral flash drive, minimum 8GB in size, with a digital copy of system closeout documents.

02 This panel shall be located near and keyed the same as the FACP. Install flush mounted in finished spaces.

03 Basis of Design: Space Age Electronics SSU00685

S. KEYS

01 Provide quantity as indicated in spare parts with closeout items.

T. LINE ISOLATOR MODULES

01 Provide at following locations at a minimum:

a. Main Panel

b. At line to temporary buildings.

c. At line to out buildings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. WIRING:

01 Fire alarm contractor shall provide and install all wiring for his system. He shall include wiring of control relays and the landing of power and control wiring to these relays to “break” control circuits or power wiring to controls transformers, door release magnets and other devices requiring shutdown. HVAC controls interlock wiring between fire alarm relay and starters, VFD’s or other temperature controls devices shall be provided by the temperature controls contractor.

02 All wiring shall be installed in conduit. In existing areas not in mechanical rooms, use metal, Wiremold surface raceway where exposed. Low smoke wiring may be installed without conduit above accessible ceilings if wiring is supported at structure or walls 48” on center with cable rings or other manufactured devices specifically designed for supporting cable. Do not support from data system cable rings. Provide conduit sleeve with protective end fittings through all walls and floors where raceway system is not installed. All connections shall be in supported junction boxes. All auxiliary control circuits shall be connected to NAC type circuits and be supervised per NFPA.

03 T-Taps or Star-Taps are not allowed.

04 Wiring outside or between buildings shall be suitable for and installed properly for this application, and comply with NEC Article 800. Provide isolation and surge suppression for all aerial and inter-building cables.

05 Wire shall be color coded in accordance with IPCEA Standards. Provide numbered labels on all wires entering annunciators, terminal boxes and the main control panel.

06 The minimum wire sizes to be used when not otherwise directed by Codes are as follows:

a.	Detector Circuits	#18 AWG
b.	Remote Annunciators	#18 AWG
c.	Remote Alarm Lamps	#18 AWG
d.	Notification Circuits:	#14 AWG (up to 1.1 A) or larger as necessary
e.	Speaker Circuits	#16 AWG Twisted/Shielded
f.	120 volt or higher	#12 AWG

g. All other wiring #18 AWG

07 Limited energy cable for 24 volt low voltage systems shall be Plastic Wire and Cable Company Low Energy Safety Control Wire, 90° C, red, or equal.

a. Provide solid core up to #14 AWG and stranded for #12 AWG and larger.

08 Should 120 volt power be required other than at the main panel, include the cost of additional circuits.

a. All additional circuits required shall be fed from the emergency power branch of the standby power system.

b. All 120V circuits shall be dedicated to fire alarm equipment only.

B. RACEWAY SYSTEMS

01 RACEWAY CAPACITY: It shall be the contractor's responsibility to determine the correct sizes of all type of raceway, to be installed, as instructed in the NEC and all applicable Codes.

02 See Section Common Work Results for Electrical for conduit types and installation requirements.

C. CEILING SUPPORTS: All devices installed in lay-in ceilings shall have bracket to support device from ceiling tees.

D. MOUNTING HEIGHTS

01 PULL STATIONS: 46" above finished floor to top

02 HORNS/SPEAKERS/STROBES: 82" or 6" below ceiling (or on ceiling)

E. LABELING:

01 All devices shall be labeled with their system address.

02 Coordinate with electrician to identify each panel and circuit serving fire alarm equipment and devices as required by code and these specifications. Labeling and lockout devices on electrical panels shall be provided and installed by division 26, reference specification 262400 ELECTRICAL SWITCHBOARDS PANELBOARDS.

03 Provide lamacoid label on front face of each power supply, expansion panel, equipment cabinet, etc. identifying the electrical circuit feeding the equipment. Where the equipment is located in a finished space the labeling may be done with a permanent marker on the inside of the cabinet where it can be easily identified.

F. REMOTE LED INDICATOR: Any automatic detection device concealed from view, such as a duct detector for an FCU above the ceiling, shall have a remote alarm lamp with engraved steel faceplate on the ceiling or wall visible from an occupied space.

3.2 TESTING

A. REQUIREMENTS: All components and circuits of the fire alarm system shall be tested under operating conditions for proper functions. The testing shall demonstrate that all requirements as herein specified have been successfully accomplished, and that the system is fully operational. Testing shall include, but shall not be limited to, the following:

01 INITIATING DEVICES: Each initiating device shall be activated and proper operation of all visual and audible alarm and auxiliary devices shall be demonstrated.

02 DUCT AND PHOTOELECTRIC DETECTORS: Each detector shall be adjusted with electronic measuring equipment for calibration sensitivity. Each detector shall subsequently be checked for operation.

03 AUDIBLE ALARM DEVICES: Each audible alarm device shall be tested for proper operation and connection to the correct circuit.

B. FIRE MARSHAL REVIEW: System shall be demonstrated to the local Fire Marshall for his review and approval. Make adjustments as required to obtain the approval for certificate of occupancy.

Provide minimum 48 hour advance notice of the demonstration to the Owner/Engineer so they may be in attendance.

3.3 SPARE PARTS AND ATTIC STOCK

A. Provide the following spare devices for each site:

01	Ceiling Smoke Detectors	Five (5)
02	Ceiling Heat Detectors	Two (2)
03	Duct Detectors	Two (2)
04	Monitor Module	Two (2)
05	Control Module	Two (2)
06	Strobes	Three (3)
07	Speakers	Three (3)
08	Speaker/Strobes	Three (3)
09	Wall Speaker/Strobes	Three (3)
10	AHU Relays	Two (2)
11	System Keys	Ten (10)

B. The fire alarm contractor shall include in their bid the cost to furnish and install the additional spare parts and attic stock and all associated cabling. These devices shall be used to fulfill any changes request issued until the list is depleted. Upon the completion of the project, all remaining material shall be delivered to the project for Owner stock. No devices shall be used without documentation and written authorization from the Owner's representative. Contractor shall obtain a signed transmittal of additional equipment to the owner at the end of the project. The signed transmittal shall be included in the contractor's closeout documents.

3.4 CLOSEOUT DOCUMENTATION

A. Upon completion of testing and certification of the system performance and operation as specified the contractor shall submit a complete set of closeout documentation in PDF format.

01 Owner's Operation Memo

02 Complete device and equipment documentation.

03 User manuals.

04 Complete As-Built Wiring Diagrams

05 Complete Fire Alarm Device & Cabling Floor Plans

06 Detector Sensitivity Settings

07 Certification of system performance and operation as specified.

08 Warranty Information

3.5 WARRANTY

A. System (materials and installation) shall be warranted for

01 A 1-year labor and materials starting at substantial completion.

02 A 2-year on labor and materials for all major equipment – Fire panel, sub-panels, amplifiers, power supplies, and remote annunciators.

03 If equipment requires repair or replacement, the warranty period starts over.

04 If the manufacturer offers a longer warranty on equipment, it shall be transferred to the Owner. Warranty and registrations information package with the equipment shall be provided to the Owner as part of the closeout documentation.

05 Problem trouble shooting and repair during the warranty period shall begin within 24 hours of notification.

B. Post-warranty maintenance shall be available on contract or call basis.

3.6 TRAINING

A. Provide designated representatives of the Owner with complete technical training in the proper operation of the system, at a time mutually convenient. They shall assist in the preparation of a set of detailed operating instructions for the system.

B. Provide number of hours and quantity of training sessions to Owner's general and maintenance personnel per system:

01 Initial training shall occur after the Owner receives the O&M manuals but before substantial completion and consist of 8 Hours (4 hours to general staff and 4 hours to maintenance personnel)

02 After final completion, the contractor shall provide follow-up training of a total of four 2-hour sessions for users and four 2-hour sessions for Maintenance. The contractor shall provide the follow-up training during the first 3 months after final completion.

END OF SECTION 28 46 00

SECTION 31 00 00

EARTHWORK

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Operations required for the excavation of materials on site.

1. Operations required for the excavation of borrow material from approved sources.
2. Compaction of natural subgrades.
3. Placement and compaction of embankments to grade.
4. Finish grading.
5. Disposal of excess or unsuitable materials.
6. Other required operations.
7. Earthwork must conform with dimensions and typical sections shown, and within lines and grades established on the Drawings.

B. The Contractor shall inform and satisfy himself as to character, quantity and distribution of material to be excavated.

1.2 EXISTING UTILITIES

A. The plans show the approximate location of all known underground utility lines and structures. Where pipes, ducts and other structures are encountered in the excavation but are not shown on the plans, immediately notify the Owner's Representative.

1.3 CLASSIFICATIONS

A. Top Soil: Top 6 inches of natural surface soil possessing the characteristics of representative soils on the site that produce growths of grass or other vegetation. Topsoil includes grasses and other vegetation.

B. Subgrade: Consists of that portion of the surface on which a compacted embankment or pavement is constructed.

C. Compacted Embankment: Earth fill placed and compacted between subgrade and underside of pavement and fill areas adjacent to paving.

D. Borrow: Material taken from approved sources to make up any deficit of excavated material. The borrow shall have a measured plasticity index of between 7 and 20, and shall be free of organic matter and excess silt.

E. Finish Grading: Operations required for smoothing disturbed areas that are not overlaid with pavement.

F. Stripping of Ground Surface: All vegetation, all decayed vegetable matter, rubbish and other unsuitable material within the areas to be graded not removed by clearing shall be stripped or otherwise removed to ground level before grading or other earthwork is started. In no case will such material be allowed to remain in or on the areas to be graded.

G. Excavation: After all necessary stripping has been done, excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings.

H. Compaction: Compaction of soil materials shall be measured as a percentage of Standard Proctor density as determined by the ASTM D698 procedure.

PART 2 P R O D U C T S

2.1 EQUIPMENT

A. Furnish, operate and maintain such equipment as is necessary to produce uniform layers, section and smoothness of grade for compaction and drainage.

B. Tamping Rollers:

1. Use tamping rollers with one or more cylindrical drums. Each cylinder must be at least 48 inches long and 40 inches in diameter.
2. The minimum weight per linear foot of drum length must be 1500 pounds weighted and 1000 pounds empty.
3. For tamping rollers with multiple cylinders, each cylinder must rotate independently and the cylinders must be pivoted on the main frame so that the units can adapt to irregularities in the ground surface.
4. Provide approximately 2.7 tamping feet per square foot of drum surface on each cylinder. Stagger the feet uniformly over the cylinder surface. Each foot should have a face area between 5 and 7 square inches and a clear projection from the cylinder surface of 7 to 9 inches. Equip each unit with a device for cleaning the feet as the cylinders rotate.
5. Use a crawler tractor with sufficient power to pull the tamping roller at a speed of approximately 3.0 miles per hour.

C. Rubber Tire Rollers:

1. Use rubber tire rollers having two axles and not less than a total of nine wheels with pneumatic tires.
2. Mount the wheels so that the rear tires will not follow in the tracks of the forward tires and so the unit will give uniform compaction over the entire width of coverage.
3. Mount the axles in a rigid frame with a loading platform or body suitable for being ballasted to a specified gross weight between 10 and 50 tons loading. The Owner's Representative will specify the tire inflation and gross weight.
4. If the roller is not self propelled, the towing equipment must also have pneumatic tires.

D. Use tank trucks, pressure distributors or other equipment designed to apply water uniformly and in controlled quantities to variable surface widths.

E. Scarifiers, disks, spring tooth or spike tooth harrows, earth hauling equipment and other equipment must be suitable for construction of fills.

2.2 EARTH FILL

A. Obtain embankment fill from required excavation or, if excavated material is not sufficient, from Borrow areas approved by the Owner's Representative.

B. Use the best material available from excavation or borrow. Suitability of fill material is subject to the approval of the Owner's Representative.

C. Fill material must be free of excessive silts. Do not use soil containing brush, roots, sod or similar perishable material.

D. Embankment material must have a plasticity index between 7 and 20 inclusive.

PART 3 E X E C U T I O N

3.1 REMOVAL OF TOPSOIL

A. Remove topsoil within the limits of the construction areas as shown on the Drawings.

B. Stockpile the topsoil for future distribution. Protect stockpiled topsoil from other excavated materials.

3.2 EXCAVATION

A. As shown on the Drawings, excavate to lines, grades and elevations required for subsequent construction of embankments or pavement. Remove materials within the indicated limits and dispose of as directed.

B. Maintain grades during excavation for complete drainage. When required, install temporary drains or drainage ditches to intercept or divert surface water and prevent interference or delay of the Work.

C. If at time of excavation it is not possible to place material in the proper section of permanent construction, stockpile the material in approved areas for later use.

D. Stones or rock fragments larger than 2 inches in their greatest dimension will not be permitted in top 6 inches of subgrade.

E. Uniformly dress cut and fill slopes to slope, cross section and alignment, as shown.

3.3 SUBGRADE UNDER PAVEMENTS

A. After excavation is made to subgrade lines under proposed pavements, remove and replace soft or undesirable material with select material as specified for embankments. Stabilize and compact the subgrade as stated in the sections on stabilization of pavement subgrade.

3.4 TREATMENT OF NATURAL SUBGRADE UNDER EMBANKMENTS

A. After excavation is made to lines under proposed embankments, remove soft or undesirable material to a depth determined by the Owner's Representative. Break down sides or holes or depressions to flatten the slopes.

B. Fill each depression with the appropriate soil for the materials to be placed on the subgrade. Place the fill in layers moistened and compacted as specified in this section.

C. After depressions have been filled and immediately before placement of compacted fill in a section of the embankment, thoroughly loosen the foundation material to a depth of 6 inches. Remove roots and debris turned up while loosening the soil.

D. Compact the surface of the embankment subgrade as specified in the following paragraphs.

E. Take care to prepare the embankment so that planes of seepage or weakness are not induced. Should the Owner's Representative suspect such a deficiency, the material must be thoroughly broken and recompacted before proceeding with construction.

3.5 PLACING EMBANKMENT FILL

A. Do not place fill on any part of the embankment subgrade until the subgrade preparation has been inspected by the Owner's Representative.

B. During the dumping and spreading process, remove all roots, stones and debris that are uncovered in the embankment material.

C. After dumping, spread the material in horizontal layers over the entire fill area. The thickness of each layer before compaction must not exceed 8 inches unless otherwise directed. As soon as possible after placement begins, crown the surface to drain freely and maintain such conditions throughout construction.

D. If the compacted surface of a layer is too smooth to bond with succeeding layers, loosen the surface by harrowing or other approved method before continuing the work.

E. Stabilize and compact the top 6 inches of embankment fills under pavement sections as specified in the section on stabilization of pavement subgrade.

3.6 MOISTURE CONTROL

A. Developing the maximum density obtainable with the natural moisture of the embankment material is preferred. However, the moisture content must be 1 to 3 percentage points wet of optimum, as determined by ASTM Test Method D698 procedure.

B. If the moisture content is too high, adjust to within the specified limits by spreading the material and permitting it to dry. Assist the drying process by discing or harrowing if necessary. When the material is too dry, sprinkle each layer with water. Work the moisture into the soil by harrowing or other approved method.

3.7 COMPACTION

A. Compact each layer of embankment with suitable rollers as necessary to secure at least 95% of the standard Proctor density, within the specified range of the moisture content, according to ASTM Test Method D698 procedure.

3.8 DISTRIBUTION OF TOPSOIL

A. Preparation:

1. Prior to placing topsoil, scarify the subgrade to a depth of 2 inches to provide effective bonding of the topsoil with the subgrade. Use a chisel plow with the chisels set 10 inches apart.
2. Shape all areas designated for grading, including cut and fill areas, to receive a minimum of 6 inches of topsoil.
3. In areas that require only blading and dressing, the adequacy of existing topsoil will be determined by the Owner's Representative.

B. Placement:

1. Do not haul or place wet topsoil. Also prohibited is placement of topsoil on a subgrade that is excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or proposed planting.

2. Distribute topsoil uniformly and spread evenly to an average thickness of 6 inches. Do no compact topsoil. Correct irregularities in the surface to prevent formation of depressions where water could stand.
3. Perform the spreading operation so that planting can proceed with little additional tillage or soil preparation. Leave the area smooth and suitable for lawn planting.

C. Where any portion of the surface becomes eroded or otherwise damaged, repair the affected area to establish the condition and grade prior to topsoil placement. Replace topsoil.

3.9 MATERIAL DISPOSAL

A. Remove excess excavated material and excess topsoil from the area before substantial completion. Stockpile materials separately in designated areas. Excess soil, topsoil and strippings shall become property of the Contractor and shall be removed from the site.

B. Dispose of waste material without causing expense or damage to the Owner.

END OF SECTION 31 00 00

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SECTION 31 06 20.15

CEMENT STABILIZED SAND

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Cement stabilized sand.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for work performed under this Section. Include cost of such work in Contract unit prices for items listed in bid form requiring cement stabilized sand.
2. Refer to Paragraph 3.04 for material credit.
3. Refer to Division 1 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 C 33 - Standard Specification for Concrete Aggregates (Fine Aggregate).

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 42 - Standard Test Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

E. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM C 150 - Specification for Portland Cement.

H. ASTM D 558 - Standard Test Method for Moisture-Density Relations of Soil Cement-Mixtures.

I. ASTM D 1632 - Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory.

J. ASTM D 1633 - Standard Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

K. ASTM D 2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

L. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

M. ASTM D 3665 - Standard Practice for Random Sampling of Construction Materials.

N. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed target cement content and production data for sand-cement mixture in accordance with requirements of Paragraph 2.03, Materials Qualifications.

1.5 DESIGN REQUIREMENTS

A. Use sand-cement mixture producing minimum unconfined compressive strength of 100 pounds per square inch (psi) in 48 hours.

1. Design will be based on strength specimens molded in accordance with ASTM D 558 at moisture content within 3 percent of optimum and within 4 hours of batching.
2. Determine minimum cement content from production data and statistical history. Provide no less than 1.5 sacks of cement per ton of dry sand.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Cement: Type I Portland cement conforming to ASTM C 150.

B. Sand: Clean, durable sand meeting grading requirements for fine aggregates of ASTM C 33, or requirements for bank run sand of Division 2 and the following requirements:

1. Classified as SW, SP, SW-SM, SP-SM, or SM by Unified Soil Classification System of ASTM D 2487.
2. Deleterious materials:
   a. Clay lumps, ASTM C 142 - less than 0.5 percent.
   b. Lightweight pieces, ASTM C 123; less than 5.0 percent.
   c. Organic impurities, ASTM C 40, color no darker than standard color.
3. Plasticity index of 4 or less when tested in accordance with ASTM D 4318.

C. Water: Potable water, free of oils, acids, alkalies, organic matter or other deleterious substances, meeting requirements of ASTM C 94.

2.2 MIXING MATERIALS

A. Add required amount of water and mix thoroughly in pugmill-type mixer.

B. Stamp batch ticket at plant with time of loading. Reject material not placed and compacted within 4 hours after mixing.

2.3 MATERIAL QUALIFICATION

A. Determine target cement content of material as follows:

1. Obtain samples of sand-cement mixtures at production facility representing range of cement content consisting of at least three points.
2. Complete molding of samples within 4 hours after addition of water.
3. Perform strength tests (average of two specimens) at 48 hours and 7 days.
4. Perform cement content tests on each sample.
5. Perform moisture content tests on each sample.
6. Plot average 48-hour strength vs. cement content.
7. Record scale calibration date, sample date, sample time, molding time, cement feed dial settings, and silo pressure (if applicable).

B. Test raw sand for following properties at point of entry into pug-mill:

1. Gradation
2. Plasticity index
3. Organic impurities
4. Clay lumps and friable particles
5. Lightweight pieces
6. Moisture content
7. Classification

C. Present data obtained in format similar to that provided in sample data form attached to this Section.

D. The target content may be adjusted when statistical history so indicates. For determination of minimum product performance use formula: f'c% 1/2 standard deviation

PART 3 E X E C U T I O N

3.1 PLACING

A. Place sand-cement mixture in maximum 12-inch-thick loose lifts and compact to 95 percent of maximum density as determined in accordance with ASTM D 558, unless otherwise specified. Refer to related specifications for thickness of lifts in other applications. Target moisture content during compaction is +3 percent of optimum. Perform and complete compaction of sand-cement mixture within 4 hours after addition of water to mix at plant.

B. Do not place or compact sand-cement mixture in standing or free water.

3.2 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. One sample of cement stabilized sand shall be obtained for each 150 tons of material placed per day with no less than one sample per day of production. Random samples of delivered cement stabilized sand shall be taken in the field at point of delivery in accordance with ASTM 3665. Obtain three individual samples of approximately 12 to 15 lb each from the first, middle, and last third of the truck and composite them into one sample for test purposes.

C. Prepare and mold four specimens (for each sample obtained) in accordance with ASTM D 558, Method A, without adjusting moisture content. Samples will be molded at approximately the same time material is being used, but no later than 4 hours after water is added to mix.

D. After molding, specimens will be removed from molds and cured in accordance with ASTM D 1632.

E. Specimens will be tested for compressive strength in accordance with ASTM D 1633, Method A. Two specimens will be tested at 48 hours plus or minus 2 hours and two specimens will be tested at 7 days plus or minus 4 hours.

F. A strength test will be average of strengths of two specimens molded from same sample of material and tested at same age. Average daily strength will be average of strengths of all specimens molded during one day's production and tested at same age.

G. Precision and Bias: Test results shall meet recommended guideline for precision in ASTM D 1633 Section 9.

H. Reporting: Test reports shall contain, as a minimum, the following information:

1. Supplier and plant number
2. Time material was batched
3. Time material was sampled
4. Test age (exact hours)
5. Average 48-hour strength
6. Average 7-day strength
7. Specification section number
8. Indication of compliance / non-compliance
9. Mixture identification 3
10. Truck and ticket numbers
11. The time of molding
12. Moisture content at time of molding
13. Required strength
14. Test method designations
15. Compressive strength data as required by ASTM D 1633
16. Supplier mixture identification
17. Specimen diameter and height, in.
18. Specimen cross-sectional area, sq. in.

3.3 ACCEPTANCE

A. Strength level of material will be considered satisfactory if:

1. The average 48-hour strength is greater than 100 psi with no individual strength test below 70 psi.
2. All 7-day individual strength tests (average of two specimens) are greater than or equal to 100 psi.

B. Material will be considered deficient when 7-day individual strength test (average of two specimens) is less than 100 psi but greater than 70 psi. See Paragraph 3.04 Adjustment for Deficient Strength.

C. The material will be considered unacceptable and subject to removal and replacement at Contractor’s expense when individual strength test (average of two specimens) has 7-day strength less than 70 psi.

D. When moving average of three daily 48-hour averages falls below 100 psi, discontinue shipment to project until plant is capable of producing material, which exceeds 100 psi at 48

hours. Five 48-hour strength tests shall be made in this determination with no individual strength tests less than 100 psi.

E. Testing laboratory shall notify Contractor, Owner's Representative, and material supplier by facsimile of tests indicating results falling below specified strength requirements within 24 hours.

F. If any strength test of laboratory cured specimens falls below the specified strength, Contractor may, at his own expense, request test of cores drilled from the area in question in accordance with ASTM C42. In such cases, three (3) cores shall be taken for each strength test that falls below the values given in 3.03.A.

G. Cement stabilized sand in an area represented by core tests shall be considered satisfactory if the average of three (3) cores is equal to at least 100 psi and if no single core is less that 70 psi. Additional testing of cores extracted from locations represented by erratic core strength results will be permitted.

3.4 ADJUSTMENT FOR DEFICIENT STRENGTH

A. When mixture produces 7-day compressive strength greater than or equal to 100 psi, then material will be considered satisfactory and bid price will be paid in full.

B. When mixture produces 7-day compressive strength less than 100 psi and greater than or equal to 70 psi, material shall be accepted contingent on credit in payment. Compute credit by the following formula: Credit per Cubic Yard = $30.00 x 2 (100 psi - Actual psi) 100

C. When mixture produces 7-day compressive strength less than 70 pounds per square inch, then remove and replace cement-sand mixture and paving and other necessary work at no cost to Owner.

END OF SECTION 31 06 20.15

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SECTION 31 06 20.17

UTILITY BACKFILL MATERIALS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Material Classifications.

B. Utility Backfill Materials:

1. Concrete sand
2. Gem sand
3. Pea gravel
4. Crushed stone
5. Crushed concrete
6. Bank run sand
7. Select backfill
8. Random backfill

C. Material Handling and Quality Control Requirements.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for backfill material. Include payment in unit price for applicable utility installation.
2. Payment for backfill material, when included as separate pay item or when directed by Owner's Representative, is on cubic yard basis for material placed and compacted within theoretical trench width limits and thickness of material according to Drawings, or as directed by Owner's Representative.
3. Payment for backfill of authorized over-excavation is in accordance with Division 31.
4. Refer to Division 1 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. Unsuitable Material:

1. Materials 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 containing large clods, aggregates, or stones greater than 4 inches in any dimension; debris, vegetation, or waste; or any other deleterious materials.
4. Materials contaminated with hydrocarbons or other chemical contaminants.

B. Suitable Material:

1. Materials meeting specification requirements.
2. Unsuitable materials meeting specification requirements for suitable soils after treatment with lime or cement.

C. Foundation Backfill Materials: Natural soil or manufactured aggregate meeting Class I requirements and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill where needed to provide stable support for structure foundation base. Foundation backfill materials may include concrete fill and seal slabs.

D. Foundation Base: Crushed stone aggregate with filter fabric as required, cement stabilized sand, or concrete seal slab. Foundation base provides smooth, level working surface for construction of concrete foundation.

E. Backfill Material: Classified soil material meeting specified quality requirements for designated application as embedment or trench zone backfill.

F. Embedment Material: Soil material placed under controlled conditions within embedment zone extending vertically upward from top of foundation to an elevation 12 inches above top of pipe, and including pipe bedding, haunching and initial backfill.

G. Trench Zone Backfill: Classified soil material meeting specified quality requirements and placed under controlled conditions in trench zone from top of embedment zone to base course in paved areas or to surface grading material in unpaved areas.

H. Foundation: Either suitable soil of trench bottom or material placed as backfill of over-excavation for removal and replacement of unsuitable or otherwise unstable soils.

I. Source: Source selected by Contractor for supply of embedment or trench zone backfill material. Selected source may be project excavation, off-site borrow pits, commercial borrow pits, or sand and aggregate production or manufacturing plants.

J. Refer to Division 33 for other definitions regarding utility installation by trench construction.

1.4 REFERENCES

A. ASTM C 33 - Standard Specification for Concrete Aggregate.

B. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

C. ASTM C 123 - Standard Test Method for Lightweight Particles in Aggregate.

D. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in Los Angeles Machine.

E. ASTM C 136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

F. ASTM C 142 - Standard Test Method for Clay Lumps and Friable Particles in Aggregates.

G. ASTM D 1140 - Standard Test Method for Amount of Material in Soils Finer Than No. 200 Sieve.

H. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. ASTM D 4643 - Standard Test Method for Determination of Water (Moisture) Content of Soil by Microwave Oven Method.

K. TxDOT Tex-110-E - Determining Particle Size Analysis of Soils.

L. TxDOT Tex-460-A - Material Finer Than 75 Fm (No.200) Sieve In Mineral Aggregates (Decantation Test for Concrete Aggregates).

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit description of source, material classification and product description, production method, and application of backfill materials.

C. Submit test results for samples of off-site backfill materials. Comply with Paragraph 2.03, Material Testing.

D. Before stockpiling materials, submit copy of approval from landowner for stockpiling backfill material on private property.

E. Provide delivery ticket which includes source location for each delivery of material that is obtained from off-site sources or is being paid as specific bid item.

1.6 TESTS

A. Perform tests of sources for backfill material in accordance with Paragraph 2.03B.

B. Verification tests of backfill materials may be performed by Owner in accordance with Division 1.

PART 2 P R O D U C T S

2.1 MATERIAL CLASSIFICATIONS

A. Classify materials for backfill for purpose of quality control in accordance with Unified Soil Classification Symbols as defined in ASTM D 2487. Material use and application is defined in utility installation specifications and Drawings either by class, as described in Paragraph 2.01B, or by product descriptions, as given in Paragraph 2.02.

B. Class Designations Based on Laboratory Testing:

1. Class I: Well-graded gravels and sands, gravel-sand mixtures, crushed well-graded rock, little or no fines (GW, SW):
   a. Plasticity index: non-plastic.
   b. Gradation: D60/D10 - greater than 4 percent; amount passing No. 200 sieve - less than or equal to 5 percent.
2. Class II: Poorly graded gravels and sands, silty gravels and sands, little to moderate fines (GM, GP, SP, SM):
   a. Plasticity index: non-plastic to 4.
   b. Gradations:
      1) Gradation (GP, SP): amount passing No. 200 sieve - less than 5 percent.
      2) Gradation (GM, SM): amount passing No. 200 sieve - between 12 percent and 50 percent.

3) Borderline gradations with dual classifications (e.g., SP-SM): amount passing No. 200 sieve - between 5 percent and 12 percent.

3. Class III: Clayey gravels and sands, poorly graded mixtures of gravel, sand, silt, and clay (GC, SC, and dual classifications, e.g., SP-SC):
   a. Plasticity index: greater than 7.
   b. Gradation: amount passing No. 200 sieve - between 12 percent and 50 percent.

4. Class IVA: Lean clays (CL).
   a. Plasticity Indexes:
      1) Plasticity index: greater than 7, and above A line.
      2) Borderline plasticity with dual classifications (CL-ML): PI between 4 and 7.
   b. Liquid limit: less than 50.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.
5. Class IVB: Fat clays (CH)
   a. Plasticity index: above A line.
   b. Liquid limit: 50 or greater.
   c. Gradation: amount passing No. 200 sieve - greater than 50 percent.
   d. Inorganic.
6. Use soils with dual class designation according to ASTM D 2487, and which are not defined above, according to more restrictive class.

2.2 PRODUCT DESCRIPTIONS

A. Soils classified as silt (ML) silty clay (CL-ML with PI of 4 to 7), elastic silt (MH), organic clay and organic silt (OL, OH), and organic matter (PT) are not acceptable as backfill materials. These soils may be used for site grading and restoration in unimproved areas as approved by Owner's Representative. Soils in Class IVB, fat clay (CH) may be used as backfill materials where allowed by applicable backfill installation specification. Refer to Division 31.

B. Provide backfill material that is free of stones greater than 6 inches, free of roots, waste, debris, trash, organic material, unstable material, non-soil matter, hydrocarbon or other contamination, conforming to following limits for deleterious materials:

1. Clay lumps: Less than 0.5 percent for Class I, and less than 2.0 percent for Class II, when tested in accordance with ASTM C 142.
2. Lightweight pieces: Less than 5 percent when tested in accordance with ASTM C 123.
3. Organic impurities: No color darker than standard color when tested in accordance with ASTM C 40.

C. Manufactured materials, such as crushed concrete, may be substituted for natural soil or rock products where indicated in product specification, and approved by Owner's Representative, provided that physical property criteria are determined to be satisfactory by testing.

D. Bank Run Sand: Durable bank run sand classified as SP, SW, or SM by Unified Soil Classification System (ASTM D 2487) meeting following requirements:

1. Less than 15 percent passing number 200 sieve when tested in accordance with ASTM D 1140. Amount of clay lumps or balls may not exceed 2 percent.
2. Material passing number 40 sieve shall meet the following requirements when tested in accordance with ASTM D 4318: Plasticity index: not exceeding 7.

E. Concrete Sand: Natural sand, manufactured sand, or combination of natural and manufactured sand conforming to requirements of ASTM C 33 and graded within following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8"	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

F. Gem Sand: Sand conforming to requirements of ASTM C 33 for course aggregates specified for number 8 size and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
3/8”	95 to 100
No. 4	60 to 80
No. 8	15 to 40

G. Pea Gravel: Durable particles composed of small, smooth, rounded stones or pebbles and graded within the following limits when tested in accordance with ASTM C 136:

Sieve	Percent Passing
1/2”	100
3/8”	85 to 100
No. 4	10 to 30
No. 8	0 to 10
No. 16	0 to 5

H. Crushed Aggregates: Crushed aggregates consist of durable particles obtained from an approved source and meeting the following requirements:

1. Materials of one product delivered for same construction activity from single source, unless otherwise approved by Owner’s Representative.
2. Non-plastic fines.
3. Los Angeles abrasion test wear not exceeding 45 percent when tested in accordance with ASTM C 131.
4. Crushed aggregate shall have minimum of 90 percent of particles retained on No. 4 sieve with 2 or more crushed faces as determined by Tex-460-A, Part I.
5. Crushed stone: Produced from oversize plant processed stone or gravel, sized by crushing to predominantly angular particles from naturally occurring single source. Uncrushed gravel is not acceptable materials for embedment where crushed stone is shown on applicable utility embedment drawing details.
6. Crushed Concrete: Crushed concrete is an acceptable substitute for crushed stone as utility backfill. Gradation and quality control test requirements are same as crushed stone. Provide crushed concrete produced from normal weight concrete of uniform quality; containing particles of aggregate and cement material, free from other substances such as asphalt, reinforcing steel fragments, soil, waste gypsum (calcium sulfate), or debris.
7. Gradations, as determined in accordance with Tex-110-E.

Sieve	Percent Passing by Weight for Pipe Embedment By Ranges of Nominal Pipes Sizes		
	>15”	15” – 8”	< 8”
1”	95 – 100	100	--
¾”	60 – 90	90 – 100	100
½”	25 – 60	--	90 – 100
3/8”	--	20 – 55	40 – 70
No. 4	0 – 5	0 – 10	0 – 15
No. 8	--	0 – 5	0 – 5

I. Select Backfill: Class III clayey gravel or sand or Class IV lean clay with plasticity index between 7 and 20 or clayey soils treated with lime in accordance with Division 31 to meet plasticity criteria.

J. Random Backfill: Any suitable soil or mixture of soils within Classes I, II, III and IV; or fat clay (CH) where allowed by applicable backfill installation specification. Refer to Division 31.

K. Cement Stabilized Sand: Conform to requirements of Division 31.

L. Concrete Backfill: Conform to Class B concrete as specified in Division 32.

M. Flexible Base Course Material: Conform to requirements of applicable portions of Division 33.

2.3 MATERIAL TESTING

A. Source Qualification. Perform testing to obtain tests by suppliers for selection of material sources and products not from the project site. Test samples of processed materials from current production representing material to be delivered. Use tests to verify that materials meet specification requirements. Repeat qualification test procedures each time source characteristics change or there is planned change in source location or supplier. Include the following qualification tests, as applicable:

1. Gradation. Report complete sieve analyses regardless of specified control sieves from largest particle through No. 200 sieve.
2. Plasticity of material passing No. 40 sieve.
3. Los Angeles abrasion wear of material retained on No. 4 sieve.
4. Clay lumps.
5. Lightweight pieces.
6. Organic impurities.

B. Production Testing. Provide reports to Owner’s Representative from an independent testing laboratory that backfill materials to be placed in Work meet applicable specification requirements.

C. Assist Owner’s Representative in obtaining material samples for verification testing at source or at production plant.

PART 3 E X E C U T I O N

3.1 SOURCES

A. Use of existing material in trench excavations is acceptable, provided applicable specification requirements are satisfied.

B. Identify off-site sources for backfill materials at least 14 days ahead of intended use so that Owner's Representative may obtain samples for verification testing.

C. Materials may be subjected to inspection or additional verification testing after delivery. Materials which do not meet requirements of specifications will be rejected. Do not use material which, after approval, has become unsuitable for use due to segregation, mixing with other materials, or by contamination. Once material is approved by Owner's Representative, expense for sampling and testing required to change to different material will be credited to Owner through change order.

D. Bank run sand, select backfill, and random backfill, if available in project excavation, may be obtained by selective excavation and acceptance testing. Obtain additional quantities of these materials and other materials required to complete work from off-site sources.

E. Owner does not represent or guarantee that any soil found in excavation work will be suitable and acceptable as backfill material.

3.2 MATERIAL HANDLING

A. When backfill material is obtained from either commercial or non-commercial borrow pit, open pit to expose vertical faces of various strata for identification and selection of approved material to be used. Excavate selected material by vertical cuts extending through exposed strata to achieve uniformity in product.

B. Establish temporary stockpile locations for practical material handling, control, and verification testing by Owner's Representative in advance of final placement. Obtain approval from landowner for storage of backfill material on adjacent private property.

C. When stockpiling backfill material near project site, use appropriate covers to eliminate blowing of materials into adjacent areas and prevent runoff containing sediments from entering drainage system.

D. Place stockpiles in layers to avoid segregation of processed materials. Load material by making successive vertical cuts through entire depth of stockpile.

3.3 FIELD QUALITY CONTROL

A. Quality Control

1. The Owner's Representative may sample and test backfill at:
   a. Sources including borrow pits, production plants and Contractor's designated off-site stockpiles.
   b. On-site stockpiles.
   c. Materials placed in Work.
2. The Owner's Representative may re-sample material at any stage of work or location if changes in characteristics are apparent.

B. Production Verification Testing: Owner's testing laboratory will provide verification testing on backfill materials, as directed by Owner's Representative. Samples may be taken at source or at production plant, as applicable.

END OF SECTION 31 06 20.17

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SECTION 31 11 00

CLEARING AND GRUBBING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removing surface debris and rubbish.

B. Clearing site of plant life and grass.

C. Removing trees and shrubs.

D. Removing root system of trees and shrubs.

E. Fence removal.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for clearing and grubbing is on per acre basis.
2. Refer to Division 1 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 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris.

B. Coordinate clearing work with utility companies.

PART 2 P R O D U C T S - Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Verify that existing plant life and features designated to remain are identified and tagged.

3.2 PROTECTION

A. Protect following from damage or displacement:
1. Living trees located 3 feet or more outside of intersection of side slopes and original ground line.
2. Plants other than trees and landscape features designated to remain.
3. Utilities designated to remain.
4. Bench marks, monuments, and existing structures designated to remain.

3.3 CLEARING

A. Remove stumps, main root ball, and root system to:

1. Depth of 24 inches below finished subgrade elevation in area bounded by lines two feet behind back of curbs.
2. Depth of 24 inches below finished surface of required cross section for other areas.

B. Clear undergrowth and deadwood without disturbing subsoil.

C. Remove vegetation from top soil scheduled for reuse.

3.4 REMOVAL

A. Remove debris, rubbish, and extracted plant material life from site in accordance with requirements of Division 1.

B. Remove on site fences. Materials generated from removal of fences become property of Contractor. Properly dispose of in accordance with applicable local, state and federal laws.

END OF SECTION 31 11 00

SECTION 31 22 00

GRADING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Removal of topsoil.

B. Rough grading the site for site structures, building pads, and play fields.

C. Replacement of topsoil and finish grading for planting.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.3 SUBMITTALS

A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 PROJECT CONDITIONS

A. Protect above- and below-grade utilities that remain.

B. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

C. Protect bench marks survey, control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Topsoil - Soil Type : Topsoil excavated on-site.
   1. Graded.
      a. Free of roots, rocks larger than 1/2 inch (12 mm), subsoil, debris, large weeds and foreign matter.
      b. Provide imported topsoil conforming to the requirements of Division 32 as required.
   2. Other Fill Materials: Reference relevant sections of Division 32 and the Drawings.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, leveler contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect utilities that remain, from damage.

D. Notify utility company to remove and relocate utilities.

3.3 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or degraded, without mixing with foreign materials.

B. Do not remove topsoil when wet.

C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

D. Do not remove wet subsoil, unless it is subsequently processed to obtain optimum moisture content.

E. When excavating through roots, perform work by hand and cut roots with sharp axe.

F. See Division 31 Specifications for filling procedures.

G. Benching Slopes: Horizontally bench existing slopes greater than 1:4 to key fill material to slope for firm bearing.

H. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 SOIL REMOVAL

A. Stockpile excavated topsoil on site.

B. Stockpile excavated subsoil on site.

C. Stockpiles: Use areas designated on site, pile depth not to exceed 8 feet (2.5 m); protect from erosion.

3.5 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch (13 mm) in size. Remove/Break-up soil clumps greater than 1” in size. Remove soil contaminated with petroleum products.

C. Where topsoil is to be placed, scarify surface to depth of 3 inches (75 mm).

D. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches (75 mm).

E. Place topsoil in areas where seeding is indicated.

F. Place topsoil where required to level finish grade.

G. Place topsoil to the following compacted thicknesses:
   1. Areas to be Seeded with Grass: 6 inches (150 mm).
   2. Areas to be Sodded: 4 inches (100 mm).

H. Place topsoil during dry weather.

I. Remove roots, weeds, rocks, and foreign material while spreading.

J. Near plants spread topsoil manually to prevent damage.

K. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

L. Lightly compact placed topsoil.

3.6 TOLERANCES

A. Top Surface of Subgrade: Plus or minus 1/10 foot (30 mm) from required elevation.

B. Top Surface of Finish Grade: Plus or minus 1/2 inch (13 mm).

3.7 FIELD QUALITY CONTROL

A. See Division 1 and Division 31 for compaction density testing.

3.8 CLEANING AND PROTECTION

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water. Excess topsoil and subsoil to be removed at no additional cost to owner.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 31 22 00

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SECTION 31 23 16.14

TRENCH SAFETY SYSTEM

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Trench Safety System for the construction of trench excavations.

B. Trench Safety System for structural excavations that fall under provisions of State and Federal trench safety laws.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices:

1. Measurement for Trench Safety Systems used on trench excavations is on a linear foot basis measured along the centerline of the trench, including manholes and other line structures.
2. No payment will be made for Trench Safety Systems for structural excavations under this section. Include payment for Trench Safety System in applicable structure installation sections.
3. Refer to Division 1 for unit price procedures.

B. 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 DEFINITIONS

A. A trench shall be defined as a narrow excavation (in relation to its depth) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet.

B. The Trench Safety System requirements will apply to larger open excavations if the erection of structures or other installations limits the space between the excavation slope and the installation to dimensions equivalent of a trench as defined.

C. Trench Safety Systems include but are not limited to sloping, sheeting, trench boxes or trench shields, sheet piling, cribbing, bracing, shoring, dewatering or diversion of water to provide adequate drainage.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of Division 1.

B. Submit a safety program specifically for the construction of trench excavation. Design the Trench Safety Program to be in accordance with OSHA 29 CFR standards governing the presence and activities of individuals working in and around trench excavations.

C. Construction and shop drawings containing deviations from OSHA standards or special designs shall be sealed by a licensed Engineer retained and paid by Contractor.

D. Review of the safety program by the Engineer will only be in regard to compliance with this specification and will not constitute approval by the Engineer nor relieve Contractor of obligations under State and Federal trench safety laws.

1.5 REGULATORY REQUIREMENTS

A. Install and maintain Trench Safety Systems in accordance with the detail specifications set out in the provision of Excavations, Trenching, and Shoring, Federal Occupation Safety and Health Administration (OSHA) Standards, 29 CFR, Part 1926, Subpart P, as amended, including Final Rule, published in the Federal Register Vol. 54, No. 209 on Tuesday, October 31, 1989. The sections that are incorporated into these specifications by reference include Sections 1926-650 through 1926-652.

B. The Contractor is responsible for obtaining a copy of OSHA standards included in "Subpart P - Excavations" from the Federal Register Vol. 54, No. 209.

C. Legislation that has been enacted by the Texas Legislature with regard to trench safety systems is hereby incorporated, by reference, into these specifications. Refer to Texas Health and Safety Code Ann., § 756.021 (Vernon 1991).

D. Reference materials, if developed for a specific project, will be issued with the Bid Documents.

1.6 INDEMNIFICATION

A. Contractor shall indemnify and hold harmless the Owner, its employees and agents, from any and all damages, costs (including, without limitation, legal fees, court costs, and the cost of investigation), judgements or claims by anyone for injury or death of persons resulting from the collapse or failure of trenches constructed under this Contract.

B. Contractor acknowledges and agrees that this indemnity provision provides indemnity for the Owner in case the Owner is negligent either by act or omission in providing for trench safety, including, but not limited to safety program and design reviews, inspections, failures to issue stop work orders, and the hiring of the Contractor.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Install and maintain Trench Safety Systems in accordance with provisions of OSHA 29 CFR.

B. Install specially designed Trench Safety Systems in accordance with the Contractor's trench excavation safety program for the locations and conditions identified in the program.

C. A competent person, as identified in the Contractor's trench safety program, shall verify that trench boxes and other premanufactured systems are certified for the actual installation conditions.

3.2 INSPECTION

A. Contractor, or Contractor's independently retained consultant, shall make daily inspections of the Trench Safety Systems to ensure that the installed systems and operations meet OSHA 29 CFR and other personnel protection regulations requirements.

B. If evidence of possible cave-ins or slides is apparent, Contractor shall immediately stop work in the trench and move personnel to safe locations until necessary precautions have been taken by Contractor to safeguard personnel entering the trench.

C. Maintain a permanent record of daily inspections.

3.3 FIELD QUALITY CONTROL

A. Contractor shall verify specific applicability of the selected or specially designed Trench Safety Systems to each field condition encountered on the project.

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SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 G E N E R A L

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 Owner's Representative directs Contractor to over-excavate trench bottom, Contractor will be paid by unit price bid per linear foot under bid item - 6" Over-excavation of Trench Bottom.
    a. No payment will be paid if Owner's Representative 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 Division 1.
3. No additional payment will be made for performing Critical Location exploratory excavation. Include cost for unit price for work requiring critical location.
4. Refer to Division 1 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 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, eductors, 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 Division 1.

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.
    c. 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 backfill material.

Q. Foundation Backfill Materials: Natural soil or manufactured aggregate of controlled gradation, and geotextile filter fabrics as required, to control drainage and material separation. Foundation backfill material is placed and compacted as backfill to provide stable support for bedding. Foundation backfill materials may include concrete seal slabs.

R. Trench Safety Systems include both protective systems and shoring systems as defined in Division 31.

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 cave-in, 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.

1.4 REFERENCES

A. ASTM C 12 - Standard Practice for Installing Vitrified Clay Pipe Lines.

B. ASTM D 558 - Standard Test Methods for Moisture-Density Relations of Soil Cement Mixtures.

C. ASTM D 698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft).

D. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.

F. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes.

G. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

H. ASTM D 3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

I. ASTM D 4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

J. TxDOT Tex-101-E - Preparing Soil and Flexible Base Materials for Testing.

K. TxDOT Tex-110-E - Particle Size Analysis of Soils.

L. 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.

1.6 SUBMITTALS

A. Conform to requirements of Division 1.

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 Division 31.

D. Submit trench excavation safety program in accordance with requirements of Division 31. 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 Owner’s Representative.

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 Owner in accordance with requirements of Division 1 and as specified in this Section.

B. Perform backfill material source qualification testing in accordance with requirements of Division 31.

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 pre-manufactured system selected by Contractor's Professional Engineer to meet project site requirements based on manufacturer's standard design.

PART 2 P R O D U C T S

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 Division 31.

B. Concrete Backfill: Conform to requirements for Class B concrete as specified in Division 31.

C. Geotextile (Filter Fabric): Conform to requirements of Division 1.

D. Concrete for Trench Dams: Concrete backfill or 3 sack premixed (bag) concrete.

E. Timber Shoring Left in Place: Untreated oak.

PART 3 E X E C U T I O N

3.1 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, and as described in this Section. Where an apparent conflict occurs between standard practice and requirements of this Section, this Section governs.

C. Classification of material will be determined by Owner’s Representative.

3.2 PREPARATION

A. Establish traffic control to conform to requirements of Division 1. 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 Division 31.

C. Immediately notify agency or company owning any existing utility line which is damaged, broken, or disturbed. Obtain approval from Owner's Representative 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 Division 2, as applicable.

E. Install and operate necessary dewatering and surface-water control measures to conform to Division 1. 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 Division 1.

3.3 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. At Critical Locations shown on Drawings, field verify horizontal and vertical locations of such lines within zone 2 feet vertically and 4 feet horizontally of proposed work.

1. Verify location of existing utilities minimum of 7 working days in advance of pipe laying activities based on daily pipe laying rate. Use extreme caution and care when uncovering these lines.
2. Notify Owner's Representative 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 Owner's Representative 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 Owner's Representative 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 Owner's Representative for approval, horizontal and vertical alignment dimensions for connections to existing lines, tied into project baseline, signed and sealed by R.P.L.S.

3.4 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 Division 1.

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, recompact, and pave those areas at no additional cost to the Owner.

3.5 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.).

Nominal Pipe Size, Inches	**Minimum Trench Width, Inches**
Less than 18	O.D. + 24
18 to 30	O.D. + 24
36 to 42	O.D. + 36
Greater than 42	O.D. + 48

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 Owner's Representative 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 Owner's Representative. 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 Owner’s Representative. 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.

3.6 HANDLING EXCAVATED MATERIALS

A. Use only excavated materials, which are suitable as defined in this Section and conforming to Division 31. 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 Division 31.

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 Division 1. Excavate trench so that pipe is centered in trench. Do not obstruct sight distance for vehicles utilizing roadway or detours with stockpiled materials.

3.7 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, overexcavate an additional 6 inches with approval by Owner's Representative. 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, if directed by Owner's Representative, in accordance with Paragraph 3.07B above. Removal of unstable or unsuitable material may be required if approved by Owner's Representative:

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 Division 1.

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.

3.8 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 Division 31. For water lines adhere to the following subparagraph numbers 1 and 2; for utility installation other than water, adhere to numbers 3 and 4 below:

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 Owner's Representative.
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.

3. 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.
4. 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.

K. 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.

3.9 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, backfill in trench zone, including auger pits, intermediate and site pits, with bank run sand, select fill, or random backfill material as specified in Division 31.

C. For sewer pipes, 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 to level 12 inches below the pavement. For sewer pipes under natural ground backfill from 12 inches above top of pipe to 6” inches below finish grade 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. Use topsoil for 6-inch backfill directly under natural grade. For backfill materials reference Division 31.

D. 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.

E. When shown on Drawings, random backfill of suitable material may be used in trench zone for trench excavations outside pavements.

F. Place trench zone backfill in lifts and compact. Fully compact each lift before placement of next lift.

1. Class I, II, III or IV or combination thereof (Random Backfill):
    a. Maximum 9-inches compacted lift thickness.
    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 of optimum determined according to ASTM D 698, unless otherwise approved by Owner’s Representative.

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. Select Backfill:
    a. Place in maximum 8-inch loose layers.
    b. Compaction by equipment providing tamping or kneading impact to minimum of 95 percent of maximum dry density determined according to ASTM D 698.
    c. Moisture content within 2 percent below or 5 percent above optimum determined according to ASTM D 698, unless approved by Owner’s Representative.

G. Unless otherwise shown on Drawings, for trench excavations not under pavement, random backfill of suitable material may be used in trench zone.

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 no additional cost to Owner, 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, INLETS, JUNCTION BOXES AND OTHER PIPELINE STRUCTURES

A. Meet requirements of adjoining utility installations for backfill of pipeline structures, as shown on Drawings.

B. Below paved areas, encapsulate structure with cement stabilized sand; minimum of 1 foot below base, minimum 2 foot around walls, up to within 12 inches of pavement subgrade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use select backfill for rigid pavements or flexible base material for asphalt pavements for 12- inch backfill directly under pavement.

C. In unpaved areas, encapsulate structure with cement stabilized sand; minimum of 1 foot below base, minimum 2 foot around walls, up to within 12 inches of finish grade. Compact in accordance with Paragraph 3.9.F.2 of this Section. Use suitable on-site material and topsoil for the 12-inch backfill directly under natural ground.

3.11 FIELD QUALITY CONTROL.

A. Test for material source qualifications as defined in Division 1.

B. Provide excavation and trench safety systems at locations and to depths required for testing and retesting during construction at no additional cost to Owner.

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 Owner’s Representative.

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 Owner's Representative, 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, 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, recompact, 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 Division 1.

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SECTION 31 31 00

SOIL TREATMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Application of soil chemicals for the prevention of termite infestation.

B. Related Sections:
   1. Section 07 26 00 - Vapor Retarders

1.2 SUBMITTALS

A. Product Data: For termiticide.
   1. Include the current EPA-Registered Label for termiticide products.

1.3 QUALITY ASSURANCE

A. Applicator Qualifications: Work shall be performed by a licensed, reputable, pest control operator with an established record of at least five years successful experience in this work.

B. Regulatory Requirements: Application of soil treatment shall meet the requirements of regulatory organizations.
   1. Texas Department of Agriculture, Structural Pest Control Service, Austin, TX.
   2. Formulate and apply termiticides according to the EPA-Registered Label.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-registered label.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard from, signed by application and contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites for a period of 5 years from date of substantial completion. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.1 2.1 SOIL TREATMENT SOLUTION

A. Termiticide: Provide an EPA-registered termiticide complying with requirements of Texas Department of Agriculture, Structural Pest Control Service, Austin, TX, in an aqueous solution formulated to prevent termite infestation. Solution shall include synthetic dye to permit visual identification of treated soil. Product/manufacturer; one of the following:
   Demon MAX; Syngenta
   BaseLine™ or Dragnet SFR; FMC Corp., Agricultural Products Group

B. Dilute termiticide as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION/PREPARATION

A. Verify the soil surfaces are unfrozen, sufficiently dry to absorb termiticide, ready to receive treatment.

B. Beginning of application means acceptance of soil conditions.

C. Notify Architect and Owner at least 12 hours prior to beginning work.

3.2 APPLICATION

A. Apply termiticide to soil at metered rates, in accordance with manufacturer's instructions or as indicated below if more stringent.

B. Applying Chemicals: Apply the solution not more than 24 hours prior to placing concrete slabs and at such time as there is reasonable assurance that no rain will fall until after the slabs have been placed.
   1. Vertical Barrier:
      a. Establish a vertical barrier in areas around the base of footings, foundation walls, grade beams, plumbing, piers, and backfill soil. Treat both sides of footings, walls, beams, and around all sides of pipes and piers.
      b. Apply at the rate of 4 gallons of emulsion per 10 linear feet per foot of depth from grade to the top of footings or the bottom of beams as each demands.
      c. Applications must be made by rodding and/or trenching in accordance with manufacturer's application instructions.
      d. Cover the treated soil with a thin layer of untreated soil or other suitable barrier such as polyethylene sheeting.
      e. Apply extra treatment to structure penetrations, pipe, ducts, expansion joints and other soil penetrations.
   2. Horizontal Barrier:
      a. Establish a horizontal barrier under concrete slabs on carton forms. Apply emulsion at the rate of 1 gallon per 10 square feet of grade.
      b. Applications shall be made by a low pressure spray.
      c. If concrete slab cannot be poured over the soil the same day it has been treated, cover treated soil immediately after application with polyethylene sheeting (Section 07 26 00 - Vapor Retarders) to prevent disturbance of the termiticide barrier.

C. Post signs in the areas of application warning workers that soil poisoning has been applied. Signs shall remain in place until areas are covered by other construction.

END OF SECTION

SECTION 31 63 29

DRILLED CONCRETE PIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete piers, including drilling, reinforcing, casing, and placing concrete.

B. Related Documents/Sections:
1. Document 00 31 32 - Geotechnical Data.
2. Section 01 45 23 - Testing and Inspection Services.
3. Section 03 20 00 - Concrete Reinforcing.
4. Section 03 30 00 - Cast-in-Place Concrete.
5. Typical Pier Detail - refer to structural drawings.

1.2 SUBMITTALS

A. Data Reports: Independent Testing Laboratory shall log each drilled shaft by recording not less than the following information:
1. Identifying mark; use same identifying mark shown on drawings.
2. Date and time excavation started;
3. Shaft diameter as per drawings;
4. Shaft diameter as constructed;
5. Bottom of penetration as per drawings;
6. Bottom of penetration as constructed;
7. Actual elevation at initial point of drilling, i.e. top of ground (in relation to sea level);
8. Estimated bearing elevation at top of penetration as per drawings (in relation to sea level);
9. Actual elevation at top of penetration as constructed (in relation to sea level);
10. Bottom of casing (if casing is used) (in relation to sea level);
11. Comments on water conditions;
12. Date and time excavation completed;
13. Date and time concrete placed;

Note: This data report does not reduce or limit the scope of work or the recording of data as required by the testing laboratory services for fulfillment of the contract documents.

B. Complete logs at the end of each day and submit a copy to the Architect for review.

C. Reconciliation of Drilled Piers and Casings: Upon completion of the construction of the drilled piers, the contractor shall reconcile the actual costs of the drilled piers and casings against the estimated costs, based on the estimated depths and sizes of piers shown on the structural drawings, the percentage of piers estimated to require casing as described in this specification, other pertinent information given in this specification and the contractor's unit prices stated on the Bid Form, which included Extra and Credit prices for drilled piers and casings.
1. The contractor shall document the total costs of the combined reconciliations of the drilled pier depths and casing lengths for submission to the Architect in a format identical to that represented by Sample Worksheets "I" and "II" included at the end of this specification section. To obtain Total Dollar Change to Contract, refer to formula on Sample Worksheet "II".
2. Refer to Sample "III", included at the end of this specification section for Glossary of Terms used in Sample Worksheets "I" and "II".

D. Confirmation of contact with Owner's testing company.

1.3 QUALITY ASSURANCE

A. Tolerances:
1. Center line of the top of the drilled shaft shall be within 3" of the plan location.
2. Drilled shaft shall be plumb to within 1½" the first 10' plus 1% of the depth greater than 10'.

B. Prior to start of shaft drilling, Contractor shall contact Owner's testing laboratory for verification and identification of bearing strata, and required penetration of bearing strata by their geotechnical engineer.

1.4 UNIT PRICES

A. Piers: Bids shall be based on drilling to estimated bearing elevation(s) plus required penetration depth as shown on typical pier detail in the structural drawings. Bids shall state unit prices per foot inclusive of drilling, reinforcing, and concrete for depths greater or less than the estimated depths as shown on typical pier detail. Adjustment of the contract sum shall be based on the total of individual shaft depths greater or less than estimated depths multiplied by their respective applicable unit price. The reconciliation of pier shaft lengths shall be calculated as shown on the "Sample "I" Pier Depth Reconciliation Worksheet" included in this specification section.

B. Casings for Piers: Bids shall include the cost of casings for 10% of the total number of piers in each pier diameter category (e.g. 18", 24", etc.). Contractor shall fill in unit prices on the bid form for casing “extra” costs and “credit” amounts for each category. After taking into account the total linear feet of casing required by the base bid for each category, the Contract sum shall be adjusted to reflect the net increase or decrease in the total linear feet of casing required for each category, multiplied by the applicable unit cost or credit amount. The reconciliation of pier casing lengths shall be calculated as shown on the "Sample "II" Pier Casing Length Reconciliation Worksheet" included in this specification section.

C. Penetrations shall be drilled to depths shown on structural drawings and shall be included in the contractor's bid. In recognition of the imprecise nature of the drilling process, payment for over-drilling penetrations shall be permitted for up to and including 8" beyond the depth shown on the structural drawings. Payments for overdrilling beyond 8" shall only be considered when recommended by the Independent Testing Laboratory as a result of conditions encountered in the field, on a per-hole basis and when such recommendation has been so noted on the pier log report.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcement shall meet the requirements specified in SECTION 03 20 00 - CONCRETE REINFORCING.

B. Concrete shall meet the requirements specified in SECTION 03 30 00 - CAST-IN-PLACE CONCRETE with the exception of the following slump requirements:
4" to 6" for dry shafts
6" to 8" if casings are used

C. Casing: ASTM A 252, Grade 2 or ASTM A 36.

D. Pier Sleds: Provide "Centraligner" sleds and Hijacker pier bolsters as manufactured by Pieresearch, Arlington, TX (phone 817.265.0980) or equivalent.

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Drilling: Drill foundation shafts with a power auger drilling machine designed for the purpose. Locate accurately and drill to the required size and depth. Underream for pier bells. Actual depth required for piers shall be determined by an engineer from the independent testing laboratory at the project site during the pier drilling operation. The pier drilling rig shall have sufficient size and power to penetrate to the required depths.

B. Cleaning: Machine clean the bottoms of shafts of loose material and debris. De-water the shafts. Shafts shall be inspected by the testing laboratory before concrete is placed.

C. Reinforcing Steel:
1. Form a cage as a structural element to maintain its shape and proportion throughout the placing of concrete and extraction of casing.
2. Install pier sleds so that reinforcing remains in position without displacement while the concrete is placed. Sled spacing and attachment shall be in accordance with sled manufacturer's recommendations.
3. Block reinforcing steel up off the bottom at least 3" with pier bolsters and fasten in place without any contact with the sides of the shaft.

D. Placing Concrete: Place concrete in each pier shaft not later than 8-hours after drilling, underreaming and cleaning of the pier hole is completed.
   1. Concrete shall be placed using a clean “tremie”. In no event shall concrete strike the sides of the excavation or the reinforcing cage. Placement by the "Free Fall" method may be implemented only at the direction of the Owner’s on-site testing laboratory.
   2. Vibrate or "rod" only the top 10' of concrete. Do not vibrate concrete of 6" slump or higher.
   3. Do not place concrete in intersecting walls and beams until the pier concrete is no longer plastic.

E. Casing:
   1. If caving soil or flowing water is encountered, use a casing to prevent caving and to exclude water. Casing shall be temporary type, to be withdrawn as the concrete is placed.
   2. If a temporary casing is used, withdraw casing as concrete is placed so that bottom of casing remains below top of concrete throughout placing operation or until top of concrete reaches stable soil free from seepage. Do not rotate casing during withdrawal.
   3. The requirement for casing of piers and the quantity of casing required for each pier, if any, shall be determined by the independent testing laboratory representative at the project site during the pier drilling operation.

3.2 FIELD QUALITY CONTROL

A. Inspection and Evaluation: The Independent Testing Laboratory shall provide full-time inspection at the project site during the drilling of shafts, installation of reinforcing steel, and placing of concrete in pier shafts. Full-time inspection shall include recording and reporting the information required in this specification.

B. The cost of the full-time inspection service shall be borne by the Owner.

C. All costs associated with reinspection, additional inspection or retesting required as a result of non-conforming work shall be borne by the Contractor.

3.3 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:
   1. Release, revoke, alter or enlarge on requirements of contract documents.
   2. Approve or accept any portion of the work.
   3. Perform any duties of the Contractor.

3.4 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel, provide access to work.

B. Furnish copies of product test reports as required.

C. Furnish incidental labor and facilities:
   1. To provide access to work to be tested.
   2. To obtain and handle samples at the Project site.
   3. To facilitate inspections and tests.
   4. For storage and curing of test samples.

D. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests. Notify laboratory immediately if there is a change in schedule to alleviate any unnecessary trips by laboratory personnel.

E. Payment for all retesting required because of nonconforming work or materials.

END OF SECTION

SAMPLE WORKSHEET "I"
PIER DEPTH RECONCILIATION WORKSHEET

PROJECT _____ PAGE _____ OF _____

PIER DIAMETER THIS PAGE _____

		A MINUS B = C x D = E				
	PIER NO.	**ESTIMATED BEARING ELEVATION**	**ACTUAL BEARING ELEVATION**	**AMOUNT DEEPER (+) OR SHALLOWER (-) THAN ESTIMATED BEARING**	**APPLICABLE UNIT PRICE FROM BID FORM (NOTE: EXTRA(+) OR CREDIT (-))**	**NET EXTRA COST OR CREDIT DUE PER PIER**
1						
2						
3						
4						
5						
6						
7						
8						
9						
						TOTAL OF COLUMN "E"

SAMPLE WORKSHEET "II"

PIER CASING LENGTH RECONCILIATION WORKSHEET

PROJECT _____ PAGE _____ OF _____

PIER DIAMETER THIS PAGE _____

		F MINUS A = G				F MINUS B = H		
	PIER NO.	GROUND ELEVATION AT PIER	ESTIMATED BEARING ELEVATION	ESTIMATED CASING LENGTH		GROUND ELEVATION AT PIER	*ACTUAL BEARING ELEVATION	ACTUAL CASING LENGTH
1								
2								
3								
				SUM OF FIGURES IN COLUMN "G"				SUM OF FIGURES IN COLUMN "H"
				x SPECIFIED BID BASIS PERCENTAGE FOR PIERS TO BE CASED				
				= TOTAL ESTIMATED CASING LENGTH				= TOTAL ACTUAL CASING LENGTH

TOTAL ACTUAL CASING LENGTH - TOTAL ESTIMATED CASING LENGTH x APPLICABLE UNIT PRICE = TOTAL COST OF CASINGS EXTRA(+) OR CREDIT(-)

TOTAL COLUMN "E" ON WORKSHEET "I" + TOTAL COST OF CASINGS ON WORKSHEET "II" = TOTAL DOLLAR CHANGE TO CONTRACT

* IF THE ELEVATION OF THE BOTTOM OF CASING DIFFERS FROM THE ACTUAL BEARING ELEVATION, USE BOTTOM OF CASING ELEVATION WHEN CALCULATING TOTAL ACTUAL CASINGS.

SAMPLE "III"
GLOSSARY OF TERMS USED IN SAMPLE WORKSHEETS "I" AND "II"

COLUMN "A" - ESTIMATED BEARING ELEVATION:

For bidding purposes, it is the estimated elevation shown on the typical pier detail in the structural drawings at which point pier penetration commences.

COLUMN "B" - ACTUAL BEARING ELEVATION:

Actual elevation at which the bearing material is encountered by each pier as determined in the field by the independent testing laboratory.

COLUMN "C" - AMOUNT DEEPER (+) OR SHALLOWER (-) THAN ESTIMATED BEARING ELEVATION:

The amount, in feet, the bearing material was encountered above or below the estimated bearing elevation.

COLUMN "D" - APPLICABLE UNIT PRICE FROM BID FORM, EXTRA (+) OR CREDIT (-):

The applicable Extra and/or Credit unit prices per linear foot including drilling, reinforcing and concrete shown on the successful contractor's Bid Form.

COLUMN "E" - NET EXTRA COST OR CREDIT DUE PER PIER:

Net extra cost or credit due per individual pier (exclusive of casing, if required).

COLUMN "F" - GROUND ELEVATION AT PIER:

The elevation of ground at pier at time pier is drilled.

COLUMN "G" - ESTIMATED CASING LENGTH:

The estimated total linear feet of casing required for bidding purposes.

COLUMN "H" - ACTUAL CASING LENGTH:

The actual total linear feet of casing utilized during drilling.

SECTION 32 11 13.13

LIME-TREATED SUBGRADES

CONDITIONS OF THE CONTRACT AND DIVISION 1, as applicable, apply to this Section.

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Foundation course of lime stabilized natural subgrade material.

1.2 MEASURMENT AND PAYMENT

A. Stipulated Price (Lump Sum). Contract is a Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 REFERENCES

A. ASTM D698 - Tests for Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 5.5 lb Rammer and 12 inch Drop.

B. ASTM D1140 - Method of Test for Amount of Material in Soils Finer than the No. 200 Sieve.

C. ASTM D1556 - Density of Soil in Place by the Sand-Cone Method.

D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

E. ASTM D3017 - Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

F. ASTM D4318 - Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

G. TxDOT Tex-600-J - Lime Testing Procedure.

H. Geotechnical Engineering Soils Report.

1.4 SUBMITTALS

A. Submittals shall conform to requirements of Division 1.

B. Submit certificates stating that hydrated lime, quicklime, or commercial lime slurry complies with these specifications.

C. Submit weight tickets, certified by supplier, with each bulk delivery of lime to work site.

D. Submit manufacturer's description and characteristics for rotary speed mixer and compaction equipment for approval.

1.5 TESTS

A. Testing will be performed under the provisions of Section - Testing Laboratory Services.

B. Tests and analysis of soil materials will be performed in accordance with ASTM D4318.

C. Sampling and testing of lime slurry shall be in accordance with Tex-600-J.

D. Sample mixtures of hydrated lime or quicklime in slurry form will be tested to establish compliance with specifications.

E. Soil will be evaluated to establish percent of hydrated lime, quicklime, or lime slurry to be applied to sub grade material.

F. Moisture-density relationship will be established on material sample from roadway, after stabilization with lime, in accordance with ASTM D698.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Bagged lime shall bear manufacturer's name, product identification, and certified weight. Bags varying more than 5 percent of certified weight may be rejected; average weight of 50 random bags in each shipment shall not be less than certified weight.

B. Store lime in weatherproof enclosures. Protect lime from ground dampness.

C. Quicklime can be dangerous; exercise extreme caution if used for the Work. Contractor shall become informed about recommended precautions in the handling, storage and use of quicklime.

PART 2P R O D U C T S

2.1 WATER

A. Water shall be clean; clear; and free from oil, acids, alkali, or vegetable matter.

2.2 LIME

A. Type A - Hydrated lime: Dry material consisting essentially of calcium hydroxide or mixture of calcium hydroxide and an allowable percentage of calcium oxide and magnesium hydroxide.

B. Type B - Commercial lime slurry: Liquid mixture consisting essentially of lime solids and water in slurry form. Water or liquid portion shall not contain dissolved material in sufficient quantity to be injurious or objectionable for purpose intended.

C. Type C - Quicklime: Dry material consisting essentially of calcium oxide. Furnish quicklime in either of the following grades:
1. Grade DS: Pebble quicklime of a gradation suitable for use in the preparation of a slurry for wet placing.
2. Grade S: Finely-graded quicklime for use in the preparation of slurry for wet placing. Do not use grade S quicklime for dry placing.

D. Lime shall conform to requirements of Item 260 of the 1993 Texas Department of Transportation Standard Specifications.

E. Lime slurry may be delivered to the job site as commercial lime, or may be prepared at the job site by using hydrated lime or quicklime. The slurry shall be free of liquids other than water and shall be of a consistency that can be handled and uniformly applied without difficulty.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify compacted sub grade is ready to support imposed loads.

B. Verify sub grade lines and grades are correct.

3.2 PREPARATION

A. Complete backfill of new utilities below future grade.

B. Cut material to bottom of sub grade using an approved cutting and pulverizing machine meeting following requirements:
   1. Cutters accurately provide a smooth surface over entire width of cut to plane of secondary grade.
   2. Visible indication that cut is to proper depth.

C. Alternatively, scarify or excavate to bottom of stabilized sub grade. Remove material or windrow to expose secondary grade. Correct wet or unstable material below secondary grade by scarifying, adding lime, and compacting. Obtain uniform stability.

3.3 LIME SLURRY APPLICATION

A. Mix hydrated lime or quicklime with water to form a slurry of the solids content specified. Commercial lime slurry shall have dry solids content as specified. Conform to cautionary requirements of Paragraph 1.06C concerning use of quicklime.

B. Apply slurry with a distributer truck equipped with an agitator to keep lime and water in a consistent mixture. Make successive passes over measured section of roadway to attain proper moisture and lime content. Limit spreading to an area where preliminary mixing operations can be completed on the same working day.

C. Apply so that dry sub grade will contain a minimum lime content of 7 percent by weight of dry sub grade unless otherwise instructed by Testing Laboratory.

3.4 PRELIMINARY MIXING

A. Do not mix and place material when temperature is below 40 degrees F and falling. Base may be placed when temperature taken in shade and away from artificial heat is above 35 degrees F and rising.

B. Use approved single-pass or multiple-pass rotary speed mixers to mix soil, lime, and water to required depth. Obtain a homogeneous friable mixture free of clods and lumps.

C. Shape mixed sub grade to final lines and grades.

D. Eliminate following operations and final mixing if pulverization requirements of Paragraph 3.05C can be met during preliminary mixing:
   1. Seal sub grade as a precaution against heavy rainfall by rolling lightly with light pneumatic rollers.
   2. Cure soil-lime material for 1 to 4 days. Keep sub grade moist during cure.

3.5 FINAL MIXING

A. Use approved single-pass or multiple-pass rotary speed mixers to uniformly mix cured soil and lime to required depth.

B. Add water to bring moisture content of soil mixture to a minimum of optimum or above.

C. Mix and pulverize until all material passes a 1-3/4-inch sieve; a minimum of 85 percent, excluding nonslacking fractions, passes a 3/4-inch sieve; and a minimum of 60 percent excluding nonslacking fractions passes a No. 4 sieve.

D. Shape mixed sub grade to final lines and grades.

E. Do not expose hydrated lime to open air for 6 hours or more during interval between application and mixing. Avoid excessive hydrated lime loss due to washing or blowing.

3.6 COMPACTION

A. Aerate or sprinkle to attain optimum moisture content as determined by Testing Laboratory. Remove and reconstruct sections where average moisture content exceeds ranges specified at time of final compaction.

B. Start compaction immediately after final mixing, unless approved by Engineer.

C. Spread and compact in two or more approximately equal layers where total compacted thickness is to be greater than 8 inches.

D. Compact with approved heavy pneumatic or vibrating rollers, or a combination of tamping rollers and light pneumatic rollers. Begin compaction at the bottom and continue until entire depth is uniformly compacted.

E. Do not allow stabilized base to mix with underlying material. Correct irregularities or weak spots immediately by replacing material and recompacting.

F. Compact to following minimum densities at a moisture content of optimum to 3 percent above optimum as determined by ASTM D698, unless otherwise indicated on the Drawings:
   1. Areas to receive pavement without subsequent base course: Minimum density of 98 percent of maximum dry density.
   2. Areas to receive subsequent base course: Minimum density of 95 percent of maximum dry density.

G. Seal with approved light pneumatic tired rollers: Prevent surface hair line cracking. Rework and recompact at areas where hair line cracking develops.

3.7 CURING

A. Moist cure for a minimum of 3 days before placing base or surface course, or opening to traffic. Time may be adjusted as approved by Engineer. Sub grade may be opened to traffic after 2 days if adequate strength has been attained to prevent damage. Restrict traffic to light pneumatic rollers or vehicles weighing less than 10 tons.

B. Keep sub grade surface damp by sprinkling. Roll with light pneumatic roller to keep surface knit together.

C. Place base, surface, or seal course within 14 days after final mixing and compaction unless prior approval is obtained from the Engineer.

3.8 TOLERANCES

A. Completed surface shall be smooth and conform to typical section and established lines and grades.

B. Top of compacted surface: Plus or minus 1/4 inch in cross section or in 16 foot length.

3.9 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Section - Testing Laboratory Services.

B. A minimum of one phenolphthalein test will be made at random locations per 1000 linear feet per lane of roadway or 500 square yards of base to determine in-place depth.

C. Contractor may, at his own expense, request additional cores in the vicinity of cores indicating nonconforming in-place depths. If the average of the tests falls below the required depth, place and compact additional material at no cost to the Owner.
   1. Compaction Testing will be performed in accordance with ASTM D1556 or ASTM D2922 and ASTM D3017 at random locations near depth determination tests. Rework and recompact areas that do not conform to compaction requirements at no cost to the Owner.

D. Fill test sections with new compacted lime stabilized sub grade.

3.10 PROTECTION

A. Maintain stabilized sub grade to lines and grades and in good condition until placement of base or surface course. Protect the asphalt membrane, if used, from being picked up by traffic.

B. Repair defects immediately by replacing material to full depth.

END OF SECTION 32 11 13.13

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SECTION 32 13 13

CONCRETE PAVING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for concrete paving is on square yard basis. Separate pay items are used for each different required thickness of pavement.
2. Payment for concrete paving, high early strength, is on square yard basis.
3. Measurement for utility projects: Match actual pavement replaced but no greater than maximum pavement replacement limits shown on Drawings.
4. Refer to Division 1 for unit price procedures.
5. Refer to Paragraph 3.15, Unit Price Adjustment.

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 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

B. ASTM A 185 - Standard Specifications for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. ASTM A 615 - Standard Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.

D. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

E. ASTM C 33 - Standard Specifications for Concrete Aggregates.

F. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

G. ASTM C 40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

H. ASTM C 42 - Standard Test Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

I. ASTM C 78 - Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading).

J. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

K. ASTM C 131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

L. ASTM C 136 - Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

M. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

N. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

O. ASTM C 150 - Standard Specification for Portland Cement.

P. ASTM C 174 - Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.

Q. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

R. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

S. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

T. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

U. TxDOT Tex-203-F - Sand Equivalent Test.

V. TxDOT Tex-406-A - Material Finer than 75 Fm (No. 200) Sieve In Mineral Aggregates (Decantation Test for Cement Aggregates).

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed mix design and test data for each type and strength of concrete in Work. Include proportions and actual flexural strength obtained from design mixes at required test ages.

C. Submit for approval manufacturer's description and characteristics for mixing equipment, and for traveling form paver, when proposed for use.

D. Submit manufacturer's certificates giving properties of reinforcing steel. Include certificate of compliance with ASTM A 82. Provide specimens for testing when required by Owner’s Representative.

1.5 HANDLING AND STORAGE

A. Do not mix different classes of aggregate without written permission of Owner’s Representative.

B. Class of aggregate being used may be changed before or during Work with written permission of Owner’s Representative. Comply new class with specifications.

C. Reject segregated aggregate. Before using aggregate whose particles are separated by size, mix them uniformly to grading requirements.

D. Reject aggregates mixed with dirt, weeds, or foreign matter.

E. Do not dump or store aggregate in roadbed.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Portland Cement:

1. Sample and test cement to verify compliance with Standards of ASTM C 150, Type I or Type III.
2. Bulk cement which meets referenced standards may be used when method of handling is approved by Owner's Representative. When using bulk cement, provide satisfactory weighing devices.
3. Fly ash which meets standards of ASTM C 618 may be used as mineral fill when method of handling is approved by Owner's Representative.

B. Water: Conform to requirements for water in ASTM C 94.

C. Coarse Aggregate: Crushed stone, gravel, or combination thereof, which is clean, hard, and durable, conforms to requirements of ASTM C 33, and has abrasion loss not more than 45 percent by weight when subjected to Los Angeles Abrasion Test (ASTM C 131).

1. Maximum percentage by weight of deleterious substances shall not exceed following values:

Item	Percent by Weight of Total Sample Maximum
Clay lumps and friable particles	3.0
Material finer than 75-um (No. 200) sieve:	
Concrete subject to abrasion	3.0*
All other concrete	5.0*
Coal and lignite:	
Where surface appearance of concrete is of importance	0.5
All other concrete	1.0

* In case of manufactured sand, when material finer than 75-µm (No. 200) sieve consists of dust of fracture, essentially free from clay or shale, these limits may be increased to 5 and 7 percent, respectively.

2. Conform coarse aggregate (size 1 1/2 inch to No. 4 sieve) to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 1¾" sieve	0
Retained on 1½" sieve	0 to 5
Retained on ¾" sieve	30 to 65
Retained on 3/8" sieve	70 to 90
Retained on No. 4 sieve	95 to 100
Loss by Decantation Test *Method Tex-406-A	1.0 maximum

* In case of aggregates made primarily from crushing of stone, when material finer than 200 sieve is dust of fracture essentially free from clay or shale as established by Part III of TxDOT Tex-406-A, percent may be increased to 1.5.

D. Fine Aggregate: Sand, manufactured sand, or combination thereof, composed of clean, hard, durable, uncoated grains, free from loams or other injurious foreign matter. Conform fine aggregate for concrete to requirements of ASTM C 33. Use gradation within following limits when graded in accordance with ASTM C 136:

Sieve Designation (Square Openings)	Percentage by Weight
Retained on 3/8" sieve	0
Retained on No. 4 sieve	0 to 5
Retained on No. 8 sieve	0 to 20
Retained on No. 16 sieve	15 to 50
Retained on No. 30 sieve	35 to 75
Retained on No. 50 sieve	65 to 90
Retained on No. 100 sieve	90 to 100
Retained on No. 200 sieve	97 to 100

1. When subjected to color test for organic impurities (ASTM C 40), fine aggregate shall not show color darker than standard color. Fine aggregate shall be subjected to Sand Equivalent Test (Tex-203-F). Sand equivalent value shall not be less than 80, unless higher value is shown on Drawings.

E. Mineral Filler: Type "C" or Type "F" fly ash of acceptable quality and meeting requirements of ASTM C 618 may be used as mineral admixture in concrete mixture as approved by the Engineer. When fly ash mineral filler is used, store and inspect in accordance with ASTM C 618. Do not use fly ash in amounts to exceed 25 percent by weight of cementatious material in mix design. Cement content may be reduced when strength requirements can be met. Note: When fly ash is used, term "cement" is defined as cement plus fly ash.

F. Air Entraining Agent: Furnish air entraining agent conforming to requirements of ASTM C 260.

G. Water Reducer: Water reducing admixture conforming to requirements of ASTM C 494 may be used when required to improve workability of concrete. Amount and type of admixture is subject to approval by Owner's Representative.

H. Reinforcing Steel:

1. Provide new billet steel manufactured by open hearth process and conforming to ASTM A 615, Grade 60. Store steel to protect it from mechanical injury and rust. At time of placement, steel shall be free from dirt, scale, rust, paint, oil, or other injurious materials.
2. Cold bend reinforcing steel to shapes shown. Once steel has been bent, it may not be rebent.
3. Provide wire fabric conforming to ASTM A 82. Use fabric in which longitudinal and transverse wires have been electrically welded at points of intersection. Welds shall have sufficient strength not to be broken during handling or placing. Conform welding and fabrication of fabric sheets to ASTM A 185.

2.2 EQUIPMENT

A. Conform Equipment to requirements of ASTM C 94.

2.3 MIXING

A. Flexural strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C78 (using simple beam with third-point loading). Compressive strength shall be as specified using test specimens prepared in accordance with ASTM C 31 and tested in accordance with ASTM C 39. Determine and measure batch quantity of each ingredient, including water for batch designs and all concrete produced for Work. Mix shall conform to these specifications and other requirements indicated on Drawings.

B. Mix design to produce concrete which will have minimum compressive strength of 3,000 psi at 7 days and 3,500 psi at 28 days. Slump of concrete shall be at least 2 inches but no more than 5 inches, when tested in accordance with ASTM C 143.

1. Concrete pavement, including curb, curb and gutter, and saw-tooth curb, shall contain at least 5 1/2 sacks (94 pounds per sack) of cement per cubic yard, with not more than 6.5 gallons of water, net, per sack of cement (water-cement ratio maximum 0.57). Determine cement content in accordance with ASTM C 138. Addition of mineral filler may be used to improve workability or plasticity of concrete to limits specified.
2. Coarse dry aggregate shall not exceed 85 percent of loose volume of concrete.
3. Add air-entraining admixture to ensure uniform distribution of agent throughout batch. Base air content of freshly mixed air-entrained concrete upon trial mixes with materials to be used in Work, adjusted to produce concrete of required plasticity and workability. Percentage of air entrainment in mix shall be 4 1/2 percent plus or minus 1 1/2 percent. Determine air content by testing in accordance with ASTM C 231.
4. Use retardant when temperature exceeds 90 degrees F. Proportion as recommended by manufacturer. Use same brand as used for air-entraining agent. Add and batch material using same methods as used for air-entraining agent.

C. Use high early strength concrete pavement to limits shown on Drawings. Design to meet following:

1. Concrete Mix: Flexural strength greater than or equal to 500 psi at 72 hours.
2. Cement: Minimum of 7 sacks of cement per cubic yard of concrete.
3. Water-Cement Ratio maximum of 0.45. Slump of concrete shall a maximum of 5 inches, when tested in accordance with ASTM C 143.
4. Other requirements for proportioning, mixing, execution, testing, etc., shall be in accordance with this Division 32.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify compacted base is ready to support imposed loads and meets compaction requirements.

B. Verify lines and grades are correct.

3.2 PREPARATION

A. Properly prepare, shape and compact each section of subgrade before placing forms, reinforcing steel or concrete. After forms have been set to proper grade and alignment, use subgrade planer to shape subgrade to its final cross section. Check contour of subgrade with template.

B. Remove subgrade that will not support loaded form. Replace and compact subgrade to required density.

3.3 EQUIPMENT

A. Alternate equipment and methods, other than those required by this Section, may be used provided equal or better results will be obtained. Maintain equipment for preparing subgrade and for finishing and compacting concrete in good working order.

B. Subgrade Planer and Template:

1. Use subgrade planer with adjustable cutting blades to trim subgrade to exact section shown on Drawings. Select planer mounted on visible rollers which ride on forms. Planer frame must have sufficient weight so that it will remain on form, and have strength and rigidity that, under tests made by changing support from wheels to center, planer will not develop deflection of more than 1/8 inch. Tractors used to pull planer shall not produce ruts or indentations in subgrade. When slip form method of paving is used, operate subgrade planer on prepared track grade or have it controlled by electronic sensor system operated from string line to establish horizontal alignment and elevation of subbase.
2. Provide template for checking contour of subgrade. Template shall be long enough to rest upon side forms and have strength and rigidity that, when supported at center, maximum deflection shall not exceed 1/8 inch. Fit template with accurately adjustable rods projecting downward at 1 foot intervals. Adjust these rods to gauge cross sections of slab bottom when template is resting on side forms.

C. Machine Finisher: Provide power-driven, transverse finishing machine designed and operated to strike off and consolidate concrete. Machine shall have two screeds accurately adjusted to crown of pavement and with frame equipped to ride on forms. Use finishing machine with rubber tires when it operates on concrete pavement.

D. Hand Finishing:

1. Provide mechanical strike and tamping template 2 feet longer than width of pavement to be finished. Shape template to pavement section.
2. Provide two bridges to ride on forms and span pavement for finishing expansion and dummy joints. Provide floats and necessary edging and finishing tools.

E. Burlap Drag or transverse broom for Finishing Slab: Furnish four plies of 10 ounce burlap material fastened to bridge to form continuous strip of burlap full width of pavement. Maintain contact 3 foot width of burlap material with pavement surface. Keep burlap drags clean and free of encrusted mortar.

F. Vibrators: Furnish mechanically-operated, synchronized vibrators mounted on tamping bar which rides on forms and hand-manipulated mechanical vibrators. Furnish vibrators with frequency of vibration to provide maximum consolidation of concrete without segregation.

G. Traveling Form Paver: Approved traveling form paver may be used in lieu of construction methods employing forms, consolidating, finishing and floating equipment. Meet requirements of this specification for subgrade, pavement tolerances, pavement depth, alignments, consolidation, finishing and workmanship. When traveling form paver does not provide concrete paving that meets compaction, finish, and tolerance requirements of this Specification, immediately discontinue its use and use conventional methods.

1. Equip traveling paver with longitudinal transangular finishing float adjustable to crown and grade. Use float long enough to extend across pavement to side forms or edge of slab.
2. Ensure that continuous deposit of concrete can be made at paver to minimize starting and stopping. Use conventional means of paving locations inaccessible to traveling paver, or having horizontal or vertical curvature that traveling paver cannot negotiate.
3. Where Drawings require tie bars for adjacent paving, securely tie and support bars to prevent displacement. Tie bars may be installed with approved mechanical bar inserter mounted on traveling-form paver. Replace pavement in which tie bars assume final position other than that shown on Drawings.

3.4 FORMS

A. Side Forms: Use forms of approved shape and section. Form depth shall be equal to required edge thickness of pavement. Forms with depths greater or than required edge thickness of pavement will be permitted, provided difference between form depth and edge thickness when not greater than 1 inch. Length of form sections shall be not less than 10 feet and each section shall provide for staking in position with not less than 3 pins. Flexible or curved forms of wood or metal of proper radius shall be used for curves of 200 foot radius or less. Forms shall have ample strength and shall be provided with adequate devices for secure setting so that when in-place they will withstand, without visible springing or settlement, impact and vibration of finishing machine. Forms shall be free from warp, bends or kinks and shall be sufficiently true to provide straight edge on concrete. Top of each form section, when tested with straight edge, shall conform to requirements specified for surface of completed pavement. Provide sufficient forms for satisfactory placement of concrete. For short radius curves, forms less than 10 feet in length or curved forms may be used.

B. Form Setting:

1. Rest forms directly on subgrade. Do not shim with pebbles or dirt. Accurately set forms to required grade and alignment and, during entire operation of placing, compacting and finishing of concrete, do not deviate from this grade and alignment more than 1/8 inch in 10 feet of length. Do not remove forms for at least 8 hours after completion of finishing operations. Provide supply of forms that will be adequate for orderly and continuous placing of concrete. Set forms and check grade for at least 300 feet ahead of mixer or as approved by Owner’s Representative.
2. Adjacent slabs may be used instead of forms, provided that concrete is well protected from possible damage by finishing equipment. Do not use adjacent slabs for forms until concrete has aged at least 7 days.

3.5 REINFORCING STEEL AND JOINT ASSEMBLIES

A. Place reinforcing steel and joint assemblies and position securely as indicated on Drawings. Wire reinforcing bars securely together at intersections and splices. Bars and coatings shall be free of rust, dirt or other foreign matter when concrete is placed. Secure reinforcing steel to chairs.

B. Position pavement joint assemblies at required locations and elevations, and rigidly secure in position. Install dowel bars in joint assemblies, each parallel to pavement surface and to center line of pavement, as shown.

C. Cut header boards, joint filler, and other material used for forming joints to receive each dowel bar.

D. Secure in required position to prevent displacement during placing and finishing of concrete.

E. Drill dowels into existing pavement, secure with epoxy, and provide paving headers as required to provide rigid pavement sections.

F. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

3.6 FIBROUS REINFORCING

A. Do not use fibrous reinforcing to replace structural, load-bearing, or moment-reinforcing steel.

3.7 PLACEMENT

A. Place concrete when air temperature taken in shade and away from artificial heat is above 35 degrees F and rising. Do not place concrete when temperature is below 40 degrees F and falling.

B. Place concrete within 90 minutes after initial water had been added. Remove and dispose of concrete not placed within this period.

C. Concrete slump during placement shall be 1 to 5 inches, except when using traveling-form paver, slump shall be maximum of 2 inches.

D. Deposit concrete continuously in successive batches. Distribute concrete in manner that will require as little rehandling as possible. Where hand spreading is necessary, distribute concrete with shovels or by other approved methods. Use only concrete rakes in handling concrete. At placement interruption of more than 30 minutes, place transverse construction joint at stopping point. Remove and replace sections less than 10 feet long.

E. Take special care in placing and spading concrete against forms and at longitudinal and transverse joints to prevent honeycombing. Voids in edge of finished pavement will be cause for rejection.

3.8 COMPACTION

A. Consolidate concrete using mechanical vibrators as specified herein. Extend vibratory unit across pavement, not quite touching side forms. Space individual vibrators at close enough intervals to vibrate and consolidate entire width of pavement uniformly. Mount mechanical vibrators to avoid contact with forms, reinforcement, transverse or longitudinal joints.

B. Furnish enough hand-manipulated mechanical vibrators for proper consolidation of concrete along forms, at joints and in areas not covered by mechanically controlled vibrators.

3.9 FINISHING

A. Finish concrete pavement with power-driven transverse finishing machines or by hand finishing methods. Hand finish with mechanical strike and tamping template in same width as pavement to be finished. Shape template to pavement section shown on Drawings. Move strike template forward in direction of placement, maintaining slight excess of material in front of cutting

edge. Make minimum of two trips over each area. Screed pavement surface to required section. Work screed with combined transverse and longitudinal motion in direction work is progressing. Maintain screed in contact with forms. Use longitudinal float to level surface.

B. On narrow strips and transitions, finish concrete pavement by hand. Thoroughly work concrete around reinforcement and embedded fixtures. Strike off concrete with strike-off screed. Move strike-off screed forward with combined transverse and longitudinal motion in direction work is progressing, maintaining screed in contact with forms, and maintaining slight excess of materials in front of cutting edge. Tamp concrete with tamping template. Use longitudinal float to level surface.

C. After completion of straightedge operation, make first pass of burlap drag or transverse broom as soon as construction operations permit and before water sheen has disappeared from surface. Follow with as many passes as required to produce desired texture depth. Permit no unnecessary delays between passes. Keep drag wet, clean and free from encrusted mortar during use.

3.10 JOINTS AND JOINT SEALING

A. Conform to requirements of Division 32.

3.11 CONCRETE CURING

A. Conform to requirements of Division 32.

3.12 TOLERANCES

A. Test entire surface before initial set and correct irregularities or undulations. Bring surface within requirements of following test and then finish. Place 10 foot straightedge parallel to center of roadway to bridge depressions and touch high spots. Do not permit ordinates measured from face of straight edge to surface of pavement to exceed 1/16 inch per foot from nearest point of contact. Maximum ordinate with 10 foot straightedge shall not exceed 1/8 inch. Grind spots in excess of required tolerances to meet surface test requirements. Restore texture by grooving concrete to meet surface finishing specifications.

3.13 FIELD QUALITY CONTROL

A. Perform testing under provisions of Division 1.

B. Compressive Strength Test Specimens: Make four test specimens for compressive strength test in accordance with ASTM C 31 for each 150 cubic yards or less of pavement that is placed in one day. Test two specimens at 7 days or at number of hours as directed by the Owner’s Representative for high early strength concrete. Test remaining two specimens at 28 days. Test specimens in accordance with ASTM C 39. Minimum compressive strength shall be 3000 pounds per square inch for first two specimens and 3500 pounds per square inch at 28 days.

C. When compressive test indicates failure, make yield test in accordance with ASTM C 138 for cement content per cubic yard of concrete. When cement content is found to be less than that specified per cubic yard, increase batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. Minimum of one 4 inch core will be taken at random locations per 375 feet per 12 feet lane or 500 square yards of pavement to measure in-place depth. Measure depth in accordance with ASTM C 174. Each core may be tested for 28 day compressive strength according to

methods of ASTM C 42. 28 day compressive strength of each core tested shall be a minimum of 3000 pounds per square inch.

E. Request, at option, three additional cores in vicinity of cores indicating nonconforming in-place depths at no cost to Owner. In-place depth at these locations shall be average depth of four cores.

F. Fill cores and density test sections with new concrete paving or non shrink grout.

3.14 NONCONFORMING PAVEMENT

A. Remove and replace areas of pavement found deficient in thickness, or that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. When measurement of any core is less than specified thickness, actual thickness of pavement in this area will be determined by taking additional cores at 10 foot intervals parallel to centerline in each direction from deficient core until, in each direction, core is taken which is not deficient by more than 10 percent. Exploratory cores for deficient thickness will not be used in averages for adjusted unit price. Exploratory cores are to be used only to determine length of pavement in unit that is to be removed and replaced. Replace nonconforming pavement sections at no additional cost to Owner.

3.15 UNIT PRICE ADJUSTMENT

A. The Owner may chose to adjustment payment for nonconforming concrete.

3.16 PAVEMENT MARKINGS

A. Restore pavement markings to match those existing in accordance with the applicable governmental standard specifications and details and Owner’s Representative's requirements.

3.17 PROTECTION

A. Barricade pavement section to prevent use until concrete has attained minimum design strength. Cure barricade pavement section for minimum 72 hours before use. Do not open pavement to traffic until concrete is at least 10 days old. Pavement may be open to traffic earlier provided Contractor pays for testing and additional specimen once 7 day specified strength is obtained. Pavement may be opened when high early strength concrete is used meeting specified 72 hour strength.

B. High early strength concrete may be used to provide access at driveways, street intersections, esplanades and other locations approved by Owner’s Representative.

C. On those sections of pavement to be opened to traffic, seal joints, clean pavement, and place earth against pavement edges before permitting use by traffic. Opening of pavement to traffic shall not relieve responsibility for Work.

D. Maintain concrete paving in good condition until completion of Work.

E. Repair defects by replacing concrete to full depth.

END OF SECTION 32 13 13

SECTION 32 13 13.10

CONCRETE PAVEMENT CURING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Curing of Portland cement concrete paving.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for concrete curing under this Section. Include payment in unit price for Concrete Paving, Concrete Sidewalks, Concrete Driveways, Curbs, and Curb and Gutters.
2. Refer to Division 1 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 C 156 - Standard Test Method for Water Retention by Concrete Curing Materials.

B. ASTM C 171 - Standard Specifications for Sheet Materials for Curing Concrete.

C. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's product data for cover materials and liquid membrane-forming compounds.

PART 2 P R O D U C T S

2.1 COVER MATERIALS FOR CURING

A. Conform curing materials to one of the following:

1. Polyethylene Film: Opaque pigmented white film conforming to requirements of ASTM C 171.
2. Waterproofed Paper: Paper conforming to requirements of ASTM C 171.
3. Cotton Mats: Single layer of cotton filler completely enclosed in cover of cotton cloth. Mats shall contain not less than 3/4 of a pound of uniformly distributed cotton filler per square yard of mat. Cotton cloth used for covering materials shall weigh not less than 6 ounces per square yard. Stitch mats so that mat will contact surface of pavement at all points when saturated with water.

2.2 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Conform liquid membrane-forming compounds to ASTM C 309. Membrane shall restrict loss of water to not more than 0.55 kg/m2 in 72 hours using test method ASTM C 156.

PART 3 E X E C U T I O N

3.1 CURING REQUIREMENT

A. Cure concrete pavement by protecting against loss of moisture for period of not less than 72 hours immediately upon completion of finishing operations. Do not use membrane curing for concrete pavement to be overlaid by asphalt concrete.

B. Failure to provide sufficient cover material shall be cause for immediate suspension of concreting operations.

3.2 POLYETHYLENE FILM CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with polyethylene film so film will remain in direct contact with surface during specified curing period.

B. Cover entire surface and both edges of pavement slab. Overlap joints in film sheets minimum of 12 inches. Immediately repair tears or holes occurring during curing period by placing acceptable moisture-proof patches or replacing.

3.3 WATERPROOFED PAPER CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, apply water in form of fine spray. Cover surface with waterproofed paper so paper will remain in direct contact with surface during specified curing period.

B. Prepare waterproofed paper to form blankets of sufficient width to cover entire surface and both edges of pavement slab, and not be more than 60 feet in length. Overlap joints in blankets caused by joining paper sheets not less than 5 inches and securely seal with asphalt cement having melting point of approximately 180 degrees F. Place blankets to secure overlap of at least 12 inches. Immediately repair tears or holes appearing in paper during curing period by cementing patches over defects.

3.4 COTTON MAT CURING

A. Immediately after finishing surface, and after concrete has taken its initial set, completely cover surface with cotton mats, thoroughly saturated before application, maintaining contact with surface of pavement equally at all points.

B. Keep mats on pavement for specified curing period. Keep mats saturated so that, when lightly compressed, water will drip freely from them. Keep banked earth or cotton mat covering edges saturated.

3.5 LIQUID MEMBRANE-FORMING COMPOUNDS

A. Immediately after free surface moisture, and after concrete has dispersed, apply liquid membrane-forming compound in accordance with manufacturer's instructions.

B. Moisten concrete by water fogging prior to application of membrane when surface has become dry.

C. Seal concrete surface with single coat at rate of coverage recommended by manufacturer and directed by Owner's Representative, but not less than one gallon per 200 square feet of surface area.

3.6 TESTING MEMBRANE

A. Treated areas will be visually inspected for areas of lighter color of dry concrete as compared to dump concrete. Test suspected areas by placing few drops of water on surface. Membrane passes test when water stands in rounded beads or small pools which can be blown along surface of concrete without wetting surface.

B. Re-Apply membrane compound immediately at no cost to Owner when membrane fails above test.

END OF SECTION 32 13 13.10

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SECTION 32 13 13.25

CONCRETE SIDEWALKS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete sidewalks.

B. Wheelchair ramps.

C. Reinforced slope paving.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for concrete sidewalks is on square foot basis.
2. No payment will be made for work outside these limits or in areas where driveway has been removed or replaced for Contractor's convenience.
3. Payment for wheelchair ramps of each type specified is on square foot basis. Removal and replacement of existing sidewalk, curb or curb and gutter and saw-cutting is paid by unit cost for each item. Sodding will be paid one foot on each side of sidewalk unless otherwise noted. Staining of wheelchair ramps is included in cost of ramp.
4. Refer to Division 1 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 C 31 - Standard Practice for Making and Curing Concrete Test Specimens in Field.

B. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

C. ASTM C 42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

D. ASTM C 138 - Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.

E. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

F. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

G. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).

H. Texas Accessibility Standards of Architectural Barriers Act, Article 9102, Texas Civil Statues.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit certified testing results and certificates of compliance.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Division 32.

B. Reinforcing Steel: Conform to material requirements of Division 32. Use No. 3 reinforcing bars.

C. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Division 32.

D. Expansion Joint Filler: Conform to material requirements for expansion joint material of Division 31.

E. Forms: Use straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. The use of 2 inch by 4 inch lumber as forms will not be allowed.

F. Sand Bed: Conform to material requirements for bank run sand of Division 31.

G. Sodding: Conform to material requirements for sodding of Division 31.

H. Coloring for wheelchair ramps: Conform to material requirements for colored concrete of Division 31. Color shall be Brick Red or as shown on the drawings.

PART 3 E X E C U T I O N

3.1 REPLACEMENT

A. Replace sidewalks and slope paving which are removed or damaged during construction with thickness and width equivalent to one removed or damaged, unless otherwise shown on Drawings. Finish surface (exposed aggregate, brick pavers, etc.) to match existing sidewalk.

B. Provide replaced and new sidewalks with wheelchair ramps when sidewalk intersects curb at street or driveway.

3.2 PREPARATION

A. Identify and protect utilities which are to remain.

B. Protect living trees, other plant growth, and features designated to remain.

C. Conduct clearing and grubbing operations in accordance with Division 31.

D. Excavate subgrade 6 inches beyond outside lines of sidewalk. Shape to line, grade and cross section. For soils with plasticity index above 40 percent, stabilize soil with lime in accordance with Division 31. Compact subgrade to minimum of 90 percent maximum dry

density at optimum to 3 percent above optimum moisture content, as determined by ASTM D 698.

E. Immediately after subgrade is prepared, begin form work and concrete placement.

3.3 PLACEMENT

A. Setting Forms: Straight, unwarped wood or metal forms with nominal depth equal to or greater than proposed sidewalk thickness. Use of 2 by 4's as forms will not be allowed. Securely stake forms to line and grade. Maintain position during concrete placement.

B. Reinforcement:

1. Install reinforcing bars.
2. Install reinforcing steel as shown on the drawings. Lay longitudinal bars in walk continuously, except through expansion joints.
3. Use sufficient number of chairs to support reinforcement in manner to maintain reinforcement in center of slab vertically during placement.
4. Drill dowels into existing paving, sidewalk and driveways, secure with epoxy, and provide headers as required.
5. Use sufficient number of chairs for steel reinforcement bars to maintain position of bars within allowable tolerances. Place reinforcement as shown on Drawings. In plane of steel parallel to nearest surface of concrete, bars shall not vary from plan placement by more than 1/12 of spacing between bars. In plane of steel perpendicular to nearest surface of concrete, bars shall not vary from plan placement by more than 1/4 inch.

C. Expansion Joints: Install expansion joints with load transfer units in accordance with Division 32.

D. Place concrete in forms to specified depth and tamp thoroughly with "jitterbug" tamp, or other acceptable method. Bring mortar to surface.

E. Strike off to smooth finish with wood strike board. Finish smoothly with wood hand float. Brush across sidewalk lightly with fine-haired brush.

F. Apply coating to wheelchair ramp with contrasting color in accordance with Division 32.

G. Unless otherwise indicated on Drawings, mark off sidewalk joints 1/8 inch deep, at spacing equal to width of walk. Use joint tool equal in width to edging tool.

H. Finish edges with tool having 1/4 inch radius.

I. After concrete has set sufficiently, refill space along sides of sidewalk to one-inch from top of walk with suitable material. Tamp until firm and solid, place sod as applicable. Dispose of excess material in accordance with Division 1. Repair driveways and parking lots damaged by sidewalk excavation in accordance with Division 32.

3.4 CURING

A. Conform to requirements of Division 32.

3.5 FIELD QUALITY CONTROL

A. Testing will be performed under provisions of Division 1.

B. Compressive Strength Test Specimens: Four test specimens for compressive strength test will be made in accordance with ASTM C 31 for each 30 cubic yards or less of sidewalk that is placed in one day. Two specimens will be tested at 7 days. Remaining two specimens will be tested at 28 days. Specimens will be tested in accordance with ASTM C 39. Minimum compressive strength: 2500 psi at 7 days and 3000 psi at 28 days.

C. Yield test for cement content per cubic yard of concrete will be made in accordance with ASTM C 138. When cement content is found to be less than that specified per cubic yard, reduce batch weights until amount of cement per cubic yard of concrete conforms to requirements.

D. If the Contractor places concrete without notifying the laboratory, the Owner will have the concrete tested by means of core test as specified in ASTM C 42. When concrete does not meet specification, cost of test will be deducted from payment.

E. Sampling of fresh concrete shall be in accordance with ASTM C 172.

F. Take slump tests when cylinders are made and when concrete slump appears excessive.

G. Concrete shall be acceptable when average of two 28 day compression tests is equal to or greater than minimum 28 day strength specified.

H. If either of two tests on field samples is less than average of two tests by more than 10 percent, that entire test shall be considered erratic and not indicative of concrete strength. Core samples will be required of in-place concrete in question.

I. If 28 day laboratory test indicates that concrete of low strength has been placed, test concrete in question by taking cores as directed by Owner’s Representative. Take and test at least three representative cores as specified in ASTM C 42 and deduct cost from payment due.

3.6 NONCONFORMING CONCRETE

A. Remove and replace areas that fail compressive strength tests, with concrete of thickness shown on Drawings.

B. Replace nonconforming sections at no additional cost to Owner.

3.7 PROTECTION

A. Maintain newly place concrete in good condition until completion of Work.

B. Replace damaged areas.

END OF SECTION 32 13 13.25

SECTION 32 13 73

CONCRETE PAVING JOINT SEALANTS

PART 1 G E N E R A L

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 Division 1 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 Division 1.

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 P R O D U C T S

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. Provide joint sealant as indicated on the drawings.

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 Owner’s Representative.

PART 3 E X E C U T I O N

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 or as shown on the drawings. 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 40 feet.

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 Owner's Representative. 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 73

SECTION 32 16 13

CURB AND GUTTERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Reinforced concrete curb, reinforced monolithic concrete curb and gutter, and mountable curb.

B. Paving headers and railroad headers poured monolithically with concrete base or pavement.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for curbs, curbs and gutter, and esplanade curbs is on linear foot basis measured along face of curb.
2. Payment for 3 foot concrete valley gutter is on a linear foot basis.
3. Payment for mountable concrete curbs is on a square foot basis.
4. Payment for concrete paving headers and concrete railroad headers is on a linear foot basis.
5. Payment for headers is on linear foot basis measured between lips of gutters adjacent to concrete base and measured between backs of curbs adjacent to concrete pavement.
6. Refer to Division 1 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 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit details of proposed form work for approval.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Conform to material and proportion requirements for concrete of Division 32.

B. Reinforcing Steel: Conform to material requirements for welded wire fabric of Division 32.

C. Grout: Nonmetallic, nonshrink grout containing no chloride producing agents conforming to following requirements.

1. Compressive strength
   a. at 7 days: 3500 psi
   b. at 28 days: 4000 psi
2. Initial set time: 45 minutes
3. Final set time: 1.5 hours

D. Preformed Expansion Joint Material: Conform to material requirements for preformed expansion joint material of Division 32.

E. Expansion Joint Filler: Conform to material requirements for expansion joint filler of Division 32.

F. Mortar: Mortar finish composed of one part Portland cement and 1 1/2 parts of fine aggregate. Use only when approved by Owner's Representative.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare subgrade in accordance with applicable portions of sections on excavation and fill, embankment, and subgrade and roadbed.

3.2 PLACEMENT

A. Guideline: Set to follow top line of curb. Attach indicator to provide constant comparison between top of curb and guideline. Ensure flow lines for monolithic curb and gutters conform to slopes indicated on Drawings.

B. Forms: Brace to maintain position during pour. Use metal templates cut to section shown on Drawings.

C. Reinforcement: Secure in position so that steel will remain in place throughout placement. Reinforcing steel shall remain at approximate center of base or pavement as indicated on Drawings.

D. Joints: Place in accordance with Division 32. Place dummy groove joints at to match concrete pavement joints at right angles to curb lines. Cut dummy grooves 1/4 inch deep using approved edging tool.

E. Place concrete in forms to required depth. Consolidate thoroughly. Do not permit rock pockets in form. Entirely cover top surfaces with mortar.

3.3 MANUAL FINISHING

A. After concrete is in place, remove front curb forms. Form exposed portions of curb, and of curb and gutter, using mule which conforms to curb shape, as shown on Drawings.

B. Thin coat of mortar may be worked into exposed face of curb using mule and two-handled wooden darby at least 3 feet long.

C. Before applying final finish move 10 foot straightedge across gutter and up curb to back form of curb. Repeat until curb and gutter are true to grade and section. Lap straightedge every 5 feet.

D. Steel trowel finish surfaces to smooth, even finish. Make face of finished curb true and straight.

E. Edge outer edge of gutter with 1/4 inch edger. Finish edges with tool having 1/4 inch radius.

F. Finish visible surfaces and edges of finished curb and gutter free from blemishes, form marks and tool marks. Finished curb or curb and gutter shall have uniform color, shape and appearance.

3.4 MECHANICAL FINISHING

A. Mechanical curb forming and finishing machines may be used instead of, or in conjunction with, previously described methods, when approved by Owner's Representative. Use of mechanical methods shall provide specified curb design and finish.

3.5 CURING

A. Immediately after finishing operations, cure exposed surfaces of curbs and gutters in accordance with Division 32.

3.6 TOLERANCES

A. Top surfaces of curb and gutter shall have uniform width and shall be free from humps, sags or other irregularities. Surfaces of curb top, curb face and gutter shall not vary more than 1/8 inch from edge of straightedge laid along them, except at grade changes.

3.7 PROTECTION

A. Maintain curbs and gutters in good condition until completion of Work.

B. Replace damaged curbs and gutters to comply with this Section.

END OF SECTION 32 16 13

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SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. This Section specifies the requirements for providing pavement markings of the following types.

1.02 UNIT PRICES

A. Measurement and payment for pavement markings is on a lump sum basis.

1.03 QUALITY ASSURANCE

A. All markings shall comply with the requirements of the SDHPT Standard Specifications for Construction of Highways, Streets and Bridges, the SDHPT Manual on Uniform Traffic Control Devices for Streets and Highways and the applicable regulations and standards of Harris County, Texas, and the City.

B. Reference Standards Applicable to this Section:

1. SDHPT: Texas State Department of Highways and Public Transportation:

   a. Standard Specifications for Construction of Highways, Streets and Bridges.
   b. Texas Manual on Uniform Traffic Control Devices for Streets and Highways (TMUTCD).
   c. The above referenced SDHPT standards may be obtained from:

      State Department of Highways & Public Transportation Highway Building
      11th and Brazos Streets
      Austin, Texas 78701
      Tel: (512) 475-2081

2. Conform to current federal VOC (Volatile Organic Compounds) regulations.

1.04 SUBMITTALS

A. Certificates:

1. Certificates shall be submitted for each product indicating that the product complies with the requirements of this specification.

B. Manufacturer's Data:

1. Manufacturer's installation instructions, specifications and recommendations shall be submitted for each pavement marking product.

1.05 JOB CONDITIONS

A. Markings shall be installed only on clean and dry surfaces. Paint markings shall be applied only when surfaces have the following minimum temperatures:

1. A minimum of 50 degrees F for asphalt and a minimum of 60 degrees F for concrete.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Paint:

1. Marking paint shall be traffic white, yellow, or as designated on the drawings.
2. Fast Drying Alkyd, Low VOC Chlorinated Rubber Traffic Paint.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Surface condition / preparation: Asphalt and concrete surfaces should be cured, clean, dry and sound. Loose and lifting paint should be removed prior to application. Concrete with sealers containing silicone, having a smooth finish, or efflorescence should be removed by etching or abrasive blasting, as these conditions may interfere with adhesion. While new asphalt surfaces vary in length of time required for curing, insufficient curing may result in bleeding. Not recommended for use over asphalt sealers. Regardless of surface condition, a test stripe should be placed inconspicuously to determine if surface is suitable before continuing.

B. Markings shall be installed, and surfaces prepared in accordance with the requirements of the applicable item in the SDHPT Standard Specifications and the TMUTCD.

C. Markings shall be protected from vehicular traffic until not subject to damage by such traffic. Contractor shall be responsible for repair and replacement of markings until written acceptance by the Owner.

END OF SECTION 32 17 23

SECTION 32 18 23.26 - NATURAL FIELD SPORT SURFACING

PART 1 GENERAL

1.1 SCOPE

A. This section specifies Texas Certified Tifway 419 Hybrid Bermuda Sod for installation on the playing fields as well as selected open areas off the playing fields.

1.2 RELATED WORK

A. Division 32, Exterior Improvements
1. 32 18 23.27 - Natural Field Installation
2. 32 18 23.28 – Natural Field Root Zone

1.3 QUALITY CONTROL

A. The Turf Contractor shall use an independent testing laboratory selected by the Owner to provide testing of selected sod. Test on sod shall be made prior to harvesting and prior to installation of delivered sod.

B. Approved Testing Laboratory.
1. Thomas Turf Services, Inc.
Mr. Jim Thomas
1501 FM 2818, Suite 302
College Station, Texas 77840-5247
Phone 409/764-2152

1.4 SUBMITTALS

A. Submit certified sample of Tifway 419 for testing by Owner's testing agent. Sample shall be one foot square with 1" of soil below the thatch layer.

B. Submit Certificates of Inspection as required by Government agencies for the sod.

1.5 DELIVERY, STORAGE AND HANDLING

A. Sod shall be delivered in netted rolls. Sod shall be temporarily stored in clean area by Turf Contractor to prevent contamination of sod. Turf Contractor shall handle sod so as to not tear
turf or displace soil from root system.

PART 2 PRODUCTS

2.1 MATERIALS

A. Playing Fields.
1. The sod shall be a Nursery grown sand based Certified Tifway 419 Sod. The sand based soil shall have a minimum of 80% sand and a maximum of 10% clay as defined by the U.S.D.A. soil classification system as provided by Turf Grass America, 4600 FM 2504, Poteet, Texas.
2. The sod soil at the growing site shall be tested for the presence of phytopatho genic nematodes by an approved Laboratory. Evidence of such test taken not more than 3

months prior to harvest shall be furnished to the Owner and evaluated for suitability. The sod shall be free of insects, broad leaf weeds, and objectionable grasses.

3. The turf shall be strongly-rooted sod (not sprigs), that has been in a mature condition of growth in the field no less than ten (10) months prior to harvest. Turf grass shall be of a vigorous growth and development.
4. The turf shall be maintained at a mowed height of 1" going from the Summer season to the Fall. The final mowing prior to harvest shall be at a height of 3/4" prior to installation.
5. The turf grass crop must be mature by April and will be subject to inspection by Owner from March through July for verification of this condition.
6. The sod will be machine stripped at a uniform thickness of 3/4" below the thatch line. The sod shall be rolled into big rolls of 42" wide and 50' long. The rolls shall be netted. The sod shall be harvested not more than 18 to 24 hours prior to installation.
7. Owner shall have sole discretion to accept or reject delivered sod.
8. Any delivered sod once accepted by Owner that becomes damaged or unsuitable for installation as determined by Owner shall be replaced by Turf Contractor at no expense to Owner.

B. Select Areas.

1. Sod for select areas shall meet the same requirements as for the playing fields as stated above under Paragraph 2.1.a.

END OF SECTION

SECTION 32 18 23.27 - NATURAL FIELD INSTALLATION

PART 1 GENERAL

1.1 SCOPE

A. Work in this section consists of installing certified and approved “big roll” turf on approved root zone materials for playing fields and select areas.

1.2 RELATED WORK

A. Division 32 – Exterior Improvements
   1. 32 80 00 - Irrigation
   2. 32 18 23.26 - Natural Field Sport Surfacing.
   3. 32 18 23.28 – Natural Field Root Zone

1.3 QUALITY CONTROL

A. Turf Contractor shall verify the root zone materials are to proper grade and thickness before proceeding with the installation of turf.

B. The installation of the natural grass field shall be made under the direct, active, personal supervision of at least three technical representatives who are employees of the natural grass Contractor/Installer. The natural grass Contractor/Installer shall have installed a minimum of ten (10) full size outdoor natural grass fields meeting NCAA field requirements. The school shall review and approve the installation crew prior to beginning work on the field.

PART 2 PRODUCTS

2.1 MATERIALS

A. The turf to be installed shall meet the requirements of SECTION 32 18 23.26.

B. Fertilizer to be added to the root zone mix shall be as recommended by the Owner’s approved testing laboratory.

C. All fertilizer shall be of uniform composition and suitable for application by a mechanical spreader.

D. Fertilizers shall be delivered in bags. Each bag shall be labeled according to State of Texas fertilizer laws.

E. Each bag of fertilizer shall have the following label information:

   1. Name brand.
   2. Name and address of manufacturer.
   3. Net pounds of fertilizer.
   4. Chemical composition.
   5. Guarantee of composition.

PART 3 EXECUTION

3.1 GENERAL

A. Turf Contractor shall coordinate the turf installation with other Contractors working at the project site.

3.2 SITE PREPARATION

A. Turf Contractor shall verify the imported topsoil for the playing fields and select areas are to plan elevations, thickness and meets testing laboratory recommendations.

B. Turf Contractor shall submit a certificate to the Owner's Representative prior to adding fertilizer and turf stating the imported topsoil for the playing fields and select areas are to plan elevations and the imported topsoil complies with the testing laboratory recommendations.

C. Owner's Representative will review the finish grade of the topsoil and will provide written approval of the work. Turf Contractor will not proceed with the turf installation without the written approval.

3.3 ROOT ZONE FERTILIZER

A. After the root zone has been approved as to grade and thickness Turf Contractor shall install a fertilizer in the upper 2 to 3 inches of the root zone.

B. Fertilizer to be installed shall meet the chemical analysis as recommended by the testing laboratory conducting fertility test on the root zone mix.

C. Dry fertilizer shall be applied just prior to the installation of turf.

D. Turf Contractor shall regrade the root zone mix to finished grade and shall keep the root zone moist until the turf is installed.

3.4 TURF INSTALLATION

A. Sod for the playing fields and select areas shall be big roll sod, 42 inches in width and 50 feet long. Sod shall be layed in a north-south direction. The sod shall be placed within 24 hours from the time the sod was harvested. Sod not placed within 24 hours of harvesting will be rejected by the Owner's Representative. Cost to replace rejected sod will be borne by the Turf Contractor.

B. Sod shall be placed on a moist root zone mix. The sod shall be laid in straight lines with the first roll being the guide for subsequent rolls. Each roll shall be placed parallel to and snug against the preceding roll. <u>All sod netting shall be removed as the roll of sod is being installed.</u>

C. Rolls of sod shall be laid so as to stagger the ends of each roll with that of the adjoining roll of turf. Do not stretch rolls of sod. End joints of sod shall be cut square.

D. Turf Contractor shall use equipment designed to install rolled turf. The machines shall have high flotation tires to minimize disturbance of the root zone surface. Heavy equipment will not be allowed on the root zone material. Any area of the root zone material that is disturbed shall be hand raked by the Turf Contractor back to finished grade.

E. Turf Contractor shall not allow turf installing equipment to operate on newly installed sod. Turf Contractor shall fill all cracks between seams. Seams of sod shall be filled by hand using root zone mix material. Turf Contractor shall hand tamp or roll sod to remove air pockets and insure sod is in contact with the root zone material.

F. Owner's Representative will inspect the installed sod and shall note any defects. Defects shall be repaired or replaced by the Turf Contractor. Repair patches shall be a minimum of 42

inches by 42 inches in size. All edges shall be square cut. Seams shall be filled in with root zone material. Patches shall be hand tamped after installation.

G. Placed sod shall be watered immediately after placement. Water sufficiently to moisten the root zone material a depth of 1 to 2 inches.

H. Owner's Representative will inspect the installed turf at the end of each days installation. Unacceptable turf shall be removed immediately and replaced with fresh turf from the next days installation. Owner's Representative shall have sole judgment as to determining unacceptable sod, and repair areas of the installed sod.

3.5 ROLLING

A. After all the sod is in place, Turf Contractor shall roll the sod with a mechanical roller weighing 2.5-4 tons. Sod shall be rolled in two directions perpendicular to each other. Rolling shall provide a uniform even surface with no visible high or low areas.

3.6 WATERING

A. The irrigation system shall be checked daily during sod installation to insure lines, valves and heads are not damaged and the system does not leak. Heads shall be adjusted to proper elevation and shall be cleaned to assure proper pop-up operation.

B. After rolling operations are complete, sod shall be watered sufficiently to wet the sod and root zone material.

C. Watering during the grow-in and maintenance period shall be daily. During the first two weeks the sod shall be watered at least three times a day. The times shall be evenly spaced between sun up and two hours before sun set. When the sod has established at least 2 to 3 inches of root system into the root zone material, the watering may be reduced to two waterings during the day. Application of water shall be at a rate of 1/4 inch per application.

3.7 GROW-IN AND MAINTENANCE PERIOD

A. The grow-in and maintenance period for the installed turf shall begin when all the project sod is in place and shall continue for 90 days.

B. Turf Contractor shall be responsible for watering, mowing, applying fertilizer, herbicides, pesticides and replacing defective sod.

C. Turf Contractor shall start mowing operations when the turf leaf blades are 1 inch high. Turf shall be cut to a height of 7/8 inch during the grow-in period. Mowing shall be on a daily basis with no more than 1/3 of the leaf blade removed at one time.

PART 4 PROJECT ACCEPTANCE

4.1 Substantial Completion:

A. At the end of the grow-in and maintenance period, Turf Contractor shall request in writing an inspection by the Owner and his representatives. Written Notice shall be given 3 days before the date of inspection.

B. The joint inspection shall be made to note any sod area that is deficient according to the project plans and specifications. The Owner or his representatives shall have sole responsibility in determining work that must done prior to final acceptance of the work.

C. To be considered substantially complete, the inspection will be based on the following criteria:

1. The root depth for the sod must be at least 3 1/2” inches based on 10 random cores of the turfed area.

2. The turf must be green, dense and void of any dead areas and weeds over the entire sodded area.

3. The turf must be smooth and level.

4. The turf is cut to a height of 9/16 inch.

5. The soil and sod must be within allowable parameters as determined by the Owner’s testing laboratory.

4.2 Final Acceptance

A. The Turf Contractor shall notify the Owner in writing 3 days in advance of when the Turf Contractor anticipates the final inspection.

B. Owner and his representatives shall review the project to determine that all defective items noted in the substantial completion have been corrected and the finished project complies with the project plans and specifications.

C. Turf Contractor shall prepare a 90-day development program with suggested mowing, watering and fertilizing schedules.

D. The Owner will issue final acceptance for the turf installation.

END OF SECTION

SECTION 32 18 23.28 - NATURAL FIELD ROOT ZONE

PART 1 GENERAL

1.1 SCOPE

A. Work in this section consists of furnishing and installing a root zone mix to support the growth of playing field sod.

1.2 RELATED WORK

A. Division 32 – Exterior Improvements

1. 32 80 00 - Irrigation
2. 32 18 23.26 - Natural Field Sport Surfacing
3. 32 18 23.27 - Natural Field Installation.

1.3 QUALITY CONTROL

A. The Turf Contractor shall use an independent testing laboratory selected by the Owner to provide testing of selected sand to used in the root zone.

B. Approved Testing Laboratory.

1. Thomas Turf Services, Inc.
Mr. Jim Thomas
1501 FM 2818, Suite 302
College Station, Texas 77840-5247
Phone 409/764-2152

1.4 SUBMITTALS

A. Submit at a minimum, a 2 gallon container of sand and a 2 gallon container of loam to be tested. Additional material shall be submitted if so requested by the Testing Laboratory in order to complete their test.

PART 2 PRODUCTS

2.1 MATERIALS

A. Root Zone Sand. - Root zone sand material shall be a washed processed sand free from organic and foreign material. Sand from soft origin shall not be used. Sand shall conform to the following analysis:

1. Particle Size.

Size	Sieve Mesh	Particle Diameter mm	Recommendation (By Weight)
Gravel	10	2.0 - 3.4	Not more than 10% of the total particles in this range, including

Very Coarse Sand	18	1.0 - 2.0	a maximum of 3% fine gravel (preferably none)
Coarse Sand	35	0.5 - 1.0	Minimum of 60% of the particles must fall within this range.
Medium	60	0.25 - 0.5	
Fine Sand	100	0.15 - 0.25	Not more than 20% of the particles may fall within this range
Very Fine Sand	270	0.05 - 0.15	Not more than 5% Total Particles in this range
Silt		0.002-0.05	Not more than 5% shall not exceed 10%
Clay		Less than 0.002	Not more than 5%

2. The physical properties of the sand shall meet the following criteria:

Physical Properties	Recommend Range
Total Porosity	35-55%
Air Filled Porosity (@ 40cm tension)	15-30%
Capillary Porosity (@ 40cm tension)	15-25%
Saturated Conductivity	9-18 inches/hr.
Organic Matter Content (by weight)	1-5% (ideally 2-4%)

B. Root Zone Soil. - Root zone soil material shall be a sandy loam consisting of the following analysis:

1. Textural Analysis:

Size	Sieve Diameter (mm)	Recommendation (By Weight)
Sand	0.05 to 2.0	Min. 65% to 80%
Silt	0.02 to 0.05	Remainder w/
Clay	below 0.002	Min. 17%

2. Sand Distribution:

Size	Sieve No.	Percent Retained
Gravel	10	3% Max.
Very Coarse Sand	18	10% Max.
Coarse Sand	35	
Medium Sand	60	Remainder of
Fine Sand	100	Combined Percentages
Very Fine Sand	270	

3. pH valve between 5.5 and 6.5

4. Maximum liquid limit of 50

Root Zone Mixture. - The root zone mixture shall consist of approximately 60% sand and 40% loam soil measured by volume of materials. The mixture of sand and loam soil shall be blended by pug mill or an approved alternate soil blender or method. The exact amounts of sand and organic material will be determined by testing of available material.

C. Fertilizer. - The root zone mixture of sand and loam soil will be tested for fertility. The testing laboratory will recommend a complete fertilizer program for the grow-in period for the sod.

PART 3 EXECUTION

3.1 DELIVERY OF ROOT ZONE MIX

A. The root zone mix is to be delivered in clean covered trucks. The material cannot be stored at the site except in an emergency. If storage is necessary, the material shall be placed on a clean hard surface with good drainage and away from waste materials. It is important that this material not be contaminated with foreign substances.

B. Owner's Representative shall observe each load of root zone mix. If irregularities are observed, samples shall be taken for test. Until subsequent test show the material to be acceptable, all deliveries of the material will stop.

3.2 PLACEMENT OF ROOT ZONE MIX

A. Turf Contractor shall verify the grade and contour of the subgrade to receive the root zone mix. The subgrade shall be smooth graded so as to receive a uniform thickness of 6 inches of root zone material. Turf Contractor shall verify irrigation is adequately in place and functioning. The subgrade shall be treated with a herbicide following manufacturer's recommendation prior to placement of the root zone mix.

B. The root zone mix shall be placed on the subgrade in such a manner as to minimize movement of equipment on the root zone material. A track mounted tractor shall be used to uniformly spread and rough grade the soil to ± 1/2" of plan elevations.

C. Upon completion of installing the root zone mix, the Turf Contractor shall operate the irrigation system one complete cycle. Fill all low spots with root zone material and water in. This process shall be repeated until all low areas are detected and corrected. Finish surface grades shall be verified using laser operated survey instruments. Do not roll the soil. Field compaction shall not exceed bulk density as determined by laboratory test.

3.3 FINE GRADING

A. The Turf Contractor shall fine grade the root zone mixture using laser operated instruments and equipment. Hand rakes shall be used to remove windrows, ruts or other variations in the surface of the root zone mix. Surface elevation shall be ± 1/4" measured horizontally between 25' x 25' grids.

B. The Turf Contractor shall maintain the root zone mix to plan elevations until sod operations begin.

C. Owner's Representative will solely determine the acceptability of the fine graded root zone area for the placement of sod. Areas to receive sod shall be firm and the drainage and irrigation system operational.

END OF SECTION

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SECTION 32 18 23.40 - POLURETHANE TRACK SURFACE BASE MAT SURFACE WITH MODIFIED STURCTURAL SPRAY COAT

PART 1 G E N E R A L

1.01 WORK INCLUDED

A. This section provides for furnishing and installing a synthetic polyurethane track surface for athletic track and field events. The synthetic surfacing will be cast-in-place upon asphaltic concrete pavement or Portland cement concrete pavement.

Track surface shall consist of black SBR granules bound together with polyurethane binder forming a permeable base mat. A pigmented polyurethane seal coat shall be applied by a squeegee to the base mat to insure that the mat is impermeable. A sprayed structural surface coat with color pigmented polyurethane binder and encapsulated pigmented EPDM rubber granules shall be applied to the surface of the seal coat.

The guidelines established in this specification are considered to be minimum acceptable standards for installing a synthetic polyurethane track surface. Higher standards for materials and rates of applications of those materials as established in published and distributed specifications by individual and separate track surface manufacturer's installers shall not be lowered to comply with the minimum requirements set forth in this specification.

1.02 ACCEPTABLE TRACK SURFACE INSTALLERS AND TRACK SURFACE SYSTEM

A. Paragon Sports Constructors
5001 Saunders Road
Fort Worth, TX, 76119
Contact: Bret Allen
Phone: 817-916-5000
Email: ballen@paragon-sports.com

B. Beynon Sport Surfaces
2110 Mountain Lake Drive
Kingwood, TX 77345
Contact: Bernie Mulvaney
Phone: 281-546-0463
Email: Bernard.mulvaney@tarkettsports.com

C. Hellas Construction , Inc.
12000 West Parmer Lane
Austin, TX 78613
Phone: 512-250-2910
Contact: Tony Heath
Email: theath@hellasconstruction.com

1.03 RELATED WORK

A. Division 2, Site Work.

1. Asphaltic Concrete Paving.
2. Track Striping.

1.04 SUBMITTALS

A. The following items are to be submitted with the Bid Form:

1. Tabulation of synthetic track surface system installations made within the past three years in which the proposed materials for this project were used. State locations, name, title, address and telephone number of contract person at each installation.

2. Manufacturer's technical specification for surfacing materials to be used, including rates of application and installation procedures. Note differences between Manufacturer's technical specifications and those contained in this section.

3. Sample of track surface system bid on Bid Form. Mark each sample with trace name or designation identification.

4. Copy of track surface warranty.

B. Submittals after Starting Work.

1. Submit certificate, signed by track surface Contractor, stating asphaltic and Portland cement concrete pavements are acceptable and satisfactory for the installation of the resilient track surface system.

2. Submit certificate from a testing laboratory stating the chemical composition of the isocyanate component of the proposed system (MDI/TDI) and stating the percentage of free TDI monomer present in the MDI/TDI isocyanate and whether this percentage of TDI is to be considered "TDI Free", non-toxic.

3. Submit certificate, signed by track surface Contractor that the synthetic track surface work, including every component, complies with the requirements of the Contract Documents, and that the installation methods were adequate and proper for the conditions of installation and use.

4. Submit three copies of a manual describing the materials, devices, and procedures to be followed for use and maintenance of the synthetic track surface system, including the cleaning, paint application, and removal techniques. Include any precautions required by warranty.

5. Submit the warranty for the synthetic track surface system.

1.05 WEATHER CONDITIONS

A. Place no synthetic track surface, primers or any component of the track surface system when the air temperature is 55 F and falling. Materials may be placed after the air temperature is above 50 F and rising. Take air temperature readings in shade away from artificial heat. Place no component of the track system when the pavement surface temperatures exceed
115 F.

B. Do not place any materials under wet or damp conditions.

1.06 DELIVERY AND STORAGE

A. Deliver materials to project site in accordance with the construction progress schedule. Components shall be identified with manufacturers' original labeling and otherwise marked to indicate location of the

Work. Store in dry location, protected against damage and according to manufacturers' recommendations.

B. All of the component materials to be used in the track surfacing shall be on site and audited by the Engineer before surfacing operations can begin.

C. All empty containers and bags shall remain on site until all track surfacing operations are complete. A final audit of materials will be made by the Engineer before empty containers and bags are removed and disposed of.

PART 2P R O D U C T S

2.01 MATERIALS

A. Rubber Granules.

1. Black SBR. The rubber granules for the base layer (mat) shall be recycled SBR rubber, cryogenically processed, chopped and graded 1 mm to 4 mm in size with less than 4% retained on a No. 50 sieve. Granules shall not contain any trace of fiber or steel. Maximum allowable moisture content shall be 0.75%.

2. EPDM Rubber. The rubber granules for the structural spray wearing coats shall be peroxide cured, man-made rubber containing a minimum of 27% EPDM and having a specific density of 1.6± 0.08 and a Shore A hardness of 60. Sulphur cured rubber is not acceptable. The granules shall be graded 0.5 mm to 1.5 mm and 0.0 mm to 0.5 mm size. EPDM granules shall be the same color as the pigmented binder.

B. Polyurethane Binders.

1. Base Mat. Binder for the black rubber base mat shall be a two component system compounded from Polyol and Isocyanate components based on Methylene Diphenyle Isocyanate (MDI) considered to be Toluylene Diphenyle Isocyanate (TDI) free (non-toxic). Binder must be compatible with SBR. Maximum specific gravity of the binder is 1.30. No mercury, lead or other hazardous toxic materials will be allowed in the composition of the binder material. The mix of polyol and isocyanate shall contain no more than 65% polyol by volume.

2. Seal Coat. Binder for the structural spray wearing coats shall be a color pigmented two component system compounded from Polyol and Isocyanate components based on Methylene Diphenyle Isocyanate (MDI) considered to be Toluylene Diphenyle Isocyanate (TDI) free (non-toxic). Maximum specific gravity of the binder is 1.30. No mercury, lead or other hazardous toxic materials will be allowed in the composition of the binder material. The mix of the polyol and isocyanate shall contain no more than 65% polyol by volume. The binding agent must be compatible with EPDM rubber granules and shall have a high ultraviolet resistance. The red pigment color shall be approved by Owner before application.

3. Structural Spray Binder. Binder for the structural spray wearing coats shall be a color pigmented two component system compounded from Polyol and Isocyanate components based on Methylene Diphenyle Isocyanate (MDI) considered to be Toluylene Diphenyle Isocyanate (TDI) free (non-toxic). Maximum specific gravity of the binder is 1.30. No mercury, lead or other hazardous toxic materials will be allowed in the composition of the binder material. The mix of the polyol and isocyanate shall contain no more than 65% polyol by volume. The binding agent must be compatible with EPDM rubber granules and shall have a high ultraviolet resistance. The red pigment color shall be approved by Owner before

application.

2.02 EQUIPMENT

A. Mixer. Mixing of binder and SBR granules shall be in a mechanical mixer. Mixer shall be kept clean and dry. Mixer shall have capacity compatible with paver lay-down capability. Mixer shall be capable of producing a homogeneous blend of materials.

B. Paver. Base mat shall be placed by a mechanically operated screed machine. The screed shall be electrically heated and oscillate to obtain both smoothness and compaction of the mat. The screed bar shall be capable of maintaining temperatures in the range of 150 F to 175 F.

C. Sprayer.

1. Polyurethane primer shall be applied by airless spray equipment.

2. Structural spray coats shall be applied by airless spray equipment designed to handle the heavy rubber mixture at a rate of at least 1.8 lbs./S.Y.

D. Hand Rollers. Light weight hand rollers coated with applicable material to prevent tacking to surface may be used to remove small irregularities. Rollers may be electrically heated.

E. Fuel Heaters. No fuel heater will be allowed.

PART 3E X E C U T I O N

3.01 WORKMANSHIP

A. The track surfacing work shall be performed by an experienced specialty firm, which shall have installed at least five synthetic polyurethane track surface systems within the last five years similar to the work required herein.

1. Track surface Contractor shall be a member in good standing with the United States Tennis Court and Track Builders Association.

2. Track surface Contractor shall use only full time company employees for installing track surfacing material. Subcontracting the installation of track surfacing material will not be allowed. Track striping work may be subcontracted to a qualified company that is acceptable to the Owner.

3. Track surface Contractor shall have all of the component materials and equipment at the site prior to starting his operations so that there will not be any delays in the installation process.

B. Pre-Installation Meeting. Prior to commencing installation of the work, and at the track surface Contractor's initiative, a meeting will be called at the project site to review material, installation procedures. Meeting shall include the track surface Contractor, Engineer and the Owner.

C. Surface Test. Before application of the surface course, the existing track surface shall be tested for planarity using a 10 foot straight edge. There shall be no deviation from the specified grade in excess of 1/8 inch. In addition to testing by straight edge, the track and field events shall be flooded with water to determine low areas that may hold water. All low areas holding water 30 minutes after flooding or when water ceases to flow and are 1/8-inches or deeper shall be clearly outlined so that necessary repairs can be made. Do not proceed with installation of surface course until all such defects have been corrected.

D. Certificate. Upon completion of surface test and correction of any defects, track surface Contractor shall submit to Engineer a signed certificate stating the existing surface is acceptable and satisfactory for the installation of his track surface system.

3.02 INSTALLATION

A. General.

1. Asphaltic concrete pavement surface course shall cure a minimum of 14 days before resilient surface material is applied.

2. The synthetic resurface layer shall be laid only on a dry, clean and oil free surface properly prepared to assure adhesion of the track surfacing material. Adhesion of the track surfacing to the asphaltic concrete pavement and Portland cement concrete pavement shall be entirely and solely the responsibility of the track surface contractor. Adhesion shall be achieved without extraneous adhesives.

3. The synthetic track surface shall be installed to a minimum total thickness of 13 mm (0.51 inches) on the athletic track and 16 mm (0.63 inches) on the high jump apron and runways.

4. The surface color for athletic track, runways and aprons shall be black when only the base mat is installed. Color samples shall be submitted to Owner prior to application of pigmented structural spray coat.

B. Impermeable Level-up. Low areas in the pavement surface shall be filled and leveled prior to installation of track surface materials. The entire low area shall be adequately filled to maintain allowable grades across the track surface. Use 100% pure polyurethane placed in single or multiple lifts to insure complete cure of the material for the thickness placed. In areas receiving in excess of 4 mm thickness of material, EPDM granulate of 1 mm to 2 mm in size may be added to the polyurethane as filler at a ratio of 25% granulate and 75% polyurethane by weight of mixture. Feather edges of the mixture to match elevations of adjacent surfaces to the low area. Check surface of level-up for grade and proper drainage.

C. Priming. The entire area to receive track surface mat shall be primed with polyurethane primer. Primer shall be applied uniformly at a rate of not less than 0.30 lbs. per square yard. Allow 30 minutes curing time before applying the base mat.

D. Base Mat. The base mat shall consist of a minimum 22% by weight polyurethane binder and 78% by weight SBR granules. The mixture shall be blended in a mechanical mixer for at least three minutes or until a homogeneous mixture is achieved with all granules fully coated. The blended materials shall be applied to the primed surface by a mechanically operated screed machine. The laying procedures shall be such to minimize cold joints. All joint work shall be flush with adjacent base mats. Joints which have cured shall have their edges toned and primed with binding agent prior to laying of adjacent base mat material.

Remove small surface irregularities with hand rollers. Protect fresh laid base mat from use for minimum period of 24 hours or until cured.

E. Seal Coat. The two polyurethane components are mixed at the prescribed ratio homogenously with a suitable mixing devise. The coating shall be squeegee applied to the base mat making it impermeable.

F. Structural Spray Coats. After base mat has properly cured one structural spray coat shall be applied only to Lanes 1 and 2 of the track followed by two structural spray coats applied to the entire surface of

the base mat. Each of the two spray coats shall be applied from different directions around the track; that is one clockwise and the other counter clockwise. The structural spray shall consist of 60% by weight of pigmented polyurethane binder and 34% by weight pigmented EPDM rubber granules with a gradation of 0.5 mm to 1.5 mm and 6% by weight EPDM rubber granule with a gradation of 0.0 mm to 0.50 mm. Each spray layer shall be applied uniformly at a rate of not less than 1.8 lbs. per square yard for a total spray layer coverage of not less than 3.6 lbs. per square yard for the two layers. The surface shall have a textured non-slip finish.

Care shall be taken to protect adjacent structures and areas from overspray. Curbing and concrete pads shall be masked to define sharp lines and to be protected from spray.

3.03 CURING TIME

A. Initial set shall be substantially complete within 72 hours. Final cure shall be substantially complete within 14 days, depending on weather conditions. Use of surface shall be curtailed until final cure is substantially complete. Track surface Contractor shall provide adequate measures to protect resilient surface during cure time.

3.04 FINAL SURFACE TEST AND REPAIRS

A. After completion of track surfacing and curing, track shall be flooded with water to determine areas that may hold water. All low areas holding water 30 minutes after rain or watering has stopped and are 3/32-inches or deeper (thickness of a nickel) shall be clearly outlined so that necessary repairs can be made.

B. In areas holding water, the base mat shall be removed. The size of the area to be removed will be determined by the Engineer. Surface layer shall be replaced and shall be made level with adjacent surfaces.

C. The track surface may be randomly probed by the Engineer in at least ten areas per 100 meter length of track to determine the finished thickness of track surface.

When the probe measurement indicates a deficiency of not more than l mm from the specified thickness, the track surface will be considered adequate. When the measurement is deficient by more than a 1 mm, two additional probes will be taken at 10 foot intervals from the deficient probes and the average thickness of the three probes will be determined.

In calculating the average thickness of the track surface, measurements which are in excess of the specified thickness will be considered as specified thickness. Measurements which are deficient of the specified thickness will be considered as specified thickness less the deficiency. If the average measurement of the three probes is not deficient more than 1 mm from the specified thickness, the track surface will be considered adequate. If the average thickness of the three probes is deficient more than 1 mm, additional exploratory probes at 5 foot intervals parallel to the centerline of the track and in each direction from the deficient probe until in each direction a probe is taken that is not deficient by more than 1 mm from the specified thickness. Exploratory probe measurements will not be used in averages for deficient track surfacing.

D. Deficient areas in excess of 1 mm of specified thickness will be resurfaced to obtain the specified thickness at the track surface Contractor's sole expense.

3.05 WARRANTY

A. The track surface Contractor/Manufacturer shall submit to the Owner the manufacturer's warranty which guarantees the usability of the track surface system for its intended uses for a minimum 5-year period commencing with the date of its final acceptance. The warranty coverage shall not be prorated nor limited by the amount of usage.

END OF SECTION

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32 18 23.60 – TRACK STRIPING

PART 1 G E N E R A L

1.01 WORK INCLUDED

A. This section provides for furnishing and installing lane striping on a synthetic track surface for athletic track.

1.02 RELATED WORK

A. Division 2, Site Work

1. Polyurethane Track Surface Base Mat Surface with Modified Structural Spray Coat.

1.03 SUBMITTALS

A. Submittals Before Starting Striping Operations

1. Detailed drawing (one reproducible and three print copies) to the Engineer for review at least two weeks in advance of scheduled striping work. Drawing shall show all lane lines and starts. Drawings shall be to scale.

2. Striper shall have one set of Engineer approved track striping drawings and project specifications at the project before any striping operations can begin.

B. Submittals Upon Completion of Striping Operations

1. Upon completion of the installation of the lines and markings for the track and field event areas, the Contractor shall furnish the Owner with a detailed drawing (one reproducible and six print copies) showing all lines and markings as installed with appropriate identifying labels.

1.04 WEATHER CONDITIONS

A. No striping operations may proceed if air temperature is 55^{O}F and falling. Striping may commence if temperature is 55^{O}F and rising. Take temperature readings in shade away from artificial heat.

B. Do not place any paint under wet or damp conditions or when relative humidity is above 85%.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Paint. Moisture cured single component aliphatic urethane with pigment added to obtain desired colors. Acrylic, oil or alkyd base paints shall not be used.

B. Equipment. Line striping machine capable of producing neat lines with clear straight edges.

C. Other: Brushes, stencils and all other incidentals to complete the work.

PART 3 E X E C U T I O N

3.01 WORKMANSHIP

A. The track striping work shall only be performed by qualified personnel who are trained and experienced in working with the specified products and on athletic track installations. Striping personnel shall have completed at least five (5) track striping projects prior to starting this project.

B. The track striping Contractor shall inspect the track surface to insure compatibility of surface and paint products for the intended work. Commencement of striping operations shall constitute acceptance of the track surface by the track striping Contractor.

3.02 TRACK AND FIELD EVENTS LAYOUT

A. Governing Rules: All lines and markings shall be laid out for a 400 meter track in accordance with the latest edition of National Federation of State High School Association, Track and Field Rules, University Interscholastic League Rules, or as specifically modified in this section.

B. Calculation Standards.

1. If using feet, calculate to the nearest 0.0001'
2. If using meters, calculate to nearest 0.0001 meters
3. One foot equals 0.3048 meters
4. Value of pi (π) equals 3.141593
5. Calculate angles to the nearest second by the formula

$$\text{Angle} = \frac{\text{Arc Distance} \times 57.29578}{\text{Radius}}$$

C. Survey

1. Personnel: All track lanes and markings and field events shall be laid out by a licensed professional engineer or a licensed land surveyor.

2. Equipment: All distances shall be measured with a certified steel tape corrected for temperature variations or an approved electronic distance meter. A Theodolite transit capable of reading direct to 20 seconds of arc shall be used for all angular measurements. Layout of lines and markings shall be made to the nearest 0.01 foot.

D. Track Events

1. The track shall be laid out and painted to accommodate continuous lanes around the track. Each lane shall be located on the track surface as shown on the drawings. Lane lines shall overlap where the curved lines and the straight away line intersect. Use dashed lines for the straightaway lines through the intersection.

2. Races: The following metric races are to be calculated for staggered starts and laid out on the track surface for striping and marking. (Verify all events with owner prior to striping track):

100M	Dash-(1 way)		
200M	Dash-(1 way)	4x400M	Relay
400M	Dash	80M	Hurdles
600M	Run	100M	Hurdles-(1 way)
800M	Run	200M	Hurdles
1200M	Run		
1600M	Run	Sprint Medly Relay	
4x100M	Relay	(100M, 100M, 200M, 100M)	

3.03 PAINTING

A. General.

1. Application

a. Apply paint at rate recommended by manufacturer of paint.

b. Coats: All lines shall receive one primer coat and one wear coat of paint. Paints shall be used directly from original containers and may not be thinned unless specified by manufacturer's directions printed on the label of the paint container.

2. Striping Contractor shall take all necessary precautions to prevent spillage of paint and any damage to track or field event area surfaces.

3. All empty paint containers shall remain at the site until final cleanup.

B. Track Events:

1. Lines: All lane lines and starting lines shall be 2" wide unless otherwise noted. All lines and markings shall be straight and accurate. Ragged edges and crooked lines will not be accepted.

2. Event Marking Symbols: See details shown on drawings.

a. Relay Exchange Zone: Triangle with 40” base and 18” height measured from the center of the base. Triangles at each end of the zone shall point toward each other in the zone.

b. Relay Acceleration Zone: Triangle with 12” base and 6” height measured from the center of the base. Triangle shall point toward the exchange zone.

c. Hurdles: Triangle with 2” sides located on the lane lines. Triangle shall point in the direction the race is to be run.

3. Color Codes:

a. Colors for all lines, exchange zones and hurdle marks shall be in accordance with the latest editionof the National Federation Track and Cross Country Rules.

b. Owner will verify the use of the above colors for the various races.

4. Special Markings:

a. Lane Numbers: Paint 3 foot high numbers in two colors for shadow effect. Base color shall be white. Four sets of numbers are required. Owner has option to request school logo or nickname to be painted on the track. Owner will furnish stencils for logo or nickname.

C. Field Events:

1. The take-in off marks in Lane 2 and lane 4 of the chute shall be painted white.

3.04 CORRECTIONS

A. Striping Contractor shall be solely responsible for refurbishing track surface to original texture and color due to paint spillage; correction of errors in track striping and marking or damage caused by striping equipment.

3.05 CLEANUP

A. Striping Contractor shall remove all empty paint containers, rags and other painting accessories from the site. Partially used containers at least one-half full of paint shall remain at the site and become the property of the Owner at the Owner's option. All unused painting supplies shall remain the property of the Striping Contractor.

END OF SECTION

SECTION 32 18 23.80 – EXTERIOR ATHLETIC EQUIPMENT

PART 1 GENERAL

1.01 SCOPE

This section covers the material and installation of exterior athletic equipment.

1.02 RELATED WORK

a. Polyurethane Track Surface Base Mat Surface with Modified Structural Spray Coat.
b. Infilled Synthetic Turf System

2.0 PRODUCTS

2.1 MATERIALS

a. All materials shall be approved and installed in accordance with University Interscholastic League (UIL) and the National Federation of High School Associations (NFHSA) Track and Field Rules, latest edition.

b. Competition Football Field Aluminum Goal Post. Sportsfield Specialties GP4380 High School Goal Posts with clear width between uprights of 23 feet - 4 inches and with 20 foot tall “high wind” model uprights, or approved alternate.

c. Pole Vault Boxes. Provide cast aluminum vault box with 105 degree angle between bottom of box and the stopboard. The angle between the side and the bottom is 120 degrees. The front buttress is a trapezoid with 6” and 16.l” parallel bases. The length of the box is 42.66”. Vault Box Model No. 711-1100 by UCS. Incorporated or Model No. TFPV001CA by Sportsfield Specialties. Phone 1-800-526-4856 or approved alternate.

d. Discus Cage. Portable cage installed to meet National Track Federation requirement. Provide 8 posts (1 7/8” diameter x 12’ long) with 14” cantilever set in permanent ground sleeves. Netting shall be 21 gage nylon treated for weather proofing (64 feet x 12 feet). Provide cage as manufactured by Buck Terrell Athletics (713/673-2577), Sportsfield Specialties or approved alternate.

e. Toe Board. Provide aluminum shot put toe board as manufactured by Aluminum Athletic Equipment Co. (Model ATB) or UCS, Inc. (Code 716-1640), Sportsfield Specialties (TFSPT001AL) or approved alternate.

f. Discus Ring. Provide ring assembly 2 1/2” x 1/4” aluminum circle 8’ - 2 7/l6” diameter. Ring assembly in two half circles. Ring assembly Model 725-2530 by UCS Incorporated, Sportsfield Specialties (TF5WRING) or approved alternate. Phone 1-800-526-4856.

g. Shot Put Ring. Provide ring assembly 1 1/2” x 1/4” aluminum circle 7’ - 0” diameter. Ring assembly in two half circles. Ring assembly Model 725-2540 by UCS Incorporated or approved alternate. Phone 1-800-526-4856.

3.0 EXECUTION

3.1 METHOD AND WORKMANSHIP

a. All materials and equipment shall be new of best quality and shall be shipped to the job and stored in appropriate protective containers to avoid damage.

b. Competition Football Field Goal Post Foundation. The 8 foot long x 8 inch diameter galvanized steel anchor sleeve shall be set in concrete. Use a 36 inch round sono-tube form to contain concrete and reinforcement. See drawings for details. The anchor sleeves must be set vertical and to the elevations shown on the drawings. The bottom of the anchor sleeve is to be closed to prevent concrete from entering the sleeve. It will be the Contractor's responsibility to remove all concrete that may enter or be dropped into the sleeve during concrete placement.

c. Aluminum Goal Post. Goal post shall be installed and assembled in accordance with the manufacturer's directions.

d. Vault Boxes. Vault boxes are to be set to alignment and grade shown on drawings so that the finish facility will meet National Collegiate Amateur Association requirements. Grade is a critical factor and shall be treated with precision by the Contractor. Contractor shall devise an anchoring system to hold the vault box while pouring concrete such that vault box will not float.

e. Discus Cage. Pipe sleeves (8) two inches diameter shall be embedded in ground with concrete at specified distances around discus pad to meet National Track Federation Ruling (Section 3 ARI.6). Install as recommended by the manufacturer.

f. Toe Board. Install aluminum toe board to concrete shot put pad as recommended by the manufacturer.

g. Discus and Shot Put Ring. Ring assembly shall be installed as shown on drawing. Ring support assembly will require 1 1/2" aluminum shims to put the top of the 2 1/2" ring at proper elevation of 4" above the initially constructed concrete pad. Ring assembly is to be anchored to initial concrete pad with set bolts. Exterior forms for second lift of concrete shall be set to the elevation of the top of the ring. The concrete pad is to be level. Make a screed to extend across the ring. Notch the ends so that the bottom of the screed is 3/4" below the notched portion and the length of the bottom screed matches the diameter of the ring. Let the notched portion of the screed ride on the top of the ring and rotate the screed to obtain the finished floor of the ring 3/4" below the top of the ring. Provide a very light broom finish to the floor of the ring. Provide 3/4" wide saw cut on each side of the ring in the concrete apron for drainage. Provide a slight slope to the saw cut from the ring to the outside edge of the apron.

END OF SECTION

SECTION 32 18 30

INFILLED SYNTHETIC TURF SYSTEM

PART 1 GENERAL

1.1 SCOPE

A. This section provides for the installation of infilled synthetic turf.

1.2 QUALITY ASSURANCE

A. The installation of the infilled synthetic turf system shall be made under the direct, active, personal supervision of at least three technical representatives who are employees of the turf system Contractor/Installer. The turf system Contractor/Installer shall have installed a minimum of ten (10) full size outdoor infilled synthetic turf football and soccer fields meeting NCAA field requirements. The school shall review and approve the installation crew prior to beginning work on the field. Only the premium line of monofilament turf handled by the Contractor/Installer will be considered for installation.

PART 2 PRODUCTS

2.1 GENERAL

A. The rubber/synthetic infilled synthetic turf system shall be suitable for all levels of competition in the sports and activities for which this field is intended. The turf system may contain a rubber granule fill or a combination sand-rubber granule fill.

The required general characteristics include the following:

01 All components of the systems shall be designed specifically for athletic and recreational use, and the pile fiber shall be made of durable polyethylene, polypropylene, nylon, or a combination of these materials. The fiber material must withstand outdoor exposure in the southeast Texas region. All components shall be resistant to insects, rot, mildew, fungus-growth and ultraviolet light for the duration of the warranty period.

02 The synthetic turf surface shall present a uniform colored playing field having the appearance of freshly mowed grass, with no irregular changes in contour or elevation. The turf surface shall provide excellent traction with the use of conventional sneaker-type shoe and regular composition-soled shoes for football. Owner to select color prior to beginning construction.

03 The synthetic turf surface shall be highly-resistant to abrasion from normal athletic and recreational traffic. It shall be non-allergic and non-toxic, and sufficiently stabilized to resist the degradation effects of ultraviolet light and outdoor exposure.

04 The primary backing of the synthetic turf surface shall resist tearing and heat degradation. The secondary backing shall be coated with

polyurethane or latex to lock in the tufts of fiber in the primary backing.

05 The synthetic turf surface shall be constructed to drain rapidly after a heavy rainfall with a minimum 10 inch/hour permeability.

06 The synthetic turf surface shall be suitable for both permanent and temporary markings.

07 The infilled synthetic turf system shall be shock-resistant to falls and have good energy absorption characteristics throughout a wide temperature range typical of the southeast Texas region.

Designed Uses:

Football, soccer, physical exercises, physical education exercises, marching band practice and drills, drill team practice and performance and other uses with similar surface activities.

B. Synthetic Turf Field Amenities.

01 The synthetic turf field shall have a standard four inch wide border around the field indicating the side line and end zone line.

02 The synthetic turf field shall have white inlaid numbers and directional arrows.

03 White inlaid lines shall be used for yard line extensions, hash marks, extra point line and boundaries of coaches/team areas.

04 White inlaid restraining lines shall be along each sideline and at each end of the field outside the end zone line.

05 Solid white 6 foot wide turf panel shall be installed in front of each coaches box.

06 Yellow perimeter soccer lines shall be inlaid along the sidelines and at each end of the end zone. The width of the soccer field shall be 190 feet and the length shall be 360 feet. Interior soccer lines will be inlaid/tufted yellow on the football field.

2.2 MANUFACTURER.

The following Manufacturer/Contractor/Installer and its football/soccer infilled synthetic turf systems are acceptable provided the system complies with the requirements of this section.

A. Paragon Sports Constructors / Shaw Sports Turf
5001 Saunders Road
Fort Worth, TX, 76119
Contact: Bret Allen
Phone: 817-916-5000
Email: ballen@paragon-sports.com

B. Field Turf / Tarkett Sports
2110 Mountain Lake Drive
Kingwood, TX 77345
Contact: Bernie Mulvaney
Phone: 281-546-0463
Email: Bernard.mulvaney@tarkettsports.com

C. Hellas Construction, Inc.
12000 West Parmer Lane
Austin, TX 78613
Contact: Tony Heath
Phone: 512-250-2910
Email: theath@hellasconstruction.com

D. Astro Turf / Symmetry Sports Construction
312 W. Alabama Street
Mt. Pleasant, TX 75455
Contact: Dusty Brinley
Phone: 512-966-8437
Email: dusty.brinley@symmetrysports.com

2.3 MATERIALS

Minimum Turf Field Specific Requirements.

Pile Fiber	Hybrid – Monofilament & Slit Film
Min. Pile Yarn Weight	48 Oz./S.Y.
Pile Height	2 ¼ inches
Turf Permeability	10 inches/hour
G max @ Installation	125G maximum
Warranty	8 years minimum
Infill	Sand & Rubber
INFILL ALTERNATE	**Inorganic Cooling Granule (Uncovered Field)**

A. Infill. The turf system may contain a rubber granule fill or a combination sand-rubber granule fill (gravel/sand infill at warning track areas).

ALTERNATE: The turf system shall contain inorganic cooling granule fill throughout the field of play of the proposed synthetic turf field. This will be for only the uncovered field.

B. Testing. All specified values for turf shall be in accordance with appropriate American Society for Testing Materials (ASTM) standards and procedures.

C. Paint. Paint for temporary markings shall be as recommended by the synthetic turf Contractor/Installer. Selection of paint colors will be determined by Owner.

D. Synthetic Sports Turf Groomer & Sweeper. Synthetic turf Contractor/Installer shall provide one synthetic sports turf groomer / sweeper “TurfCare TCA 1400” per campus equipped with super duty brushes and electric actuator all as manufactured by SMG Equipment. Synthetic turf Contractor/Installer shall provide a total of one (1) synthetic sports turf groomer / sweeper.

E. Bases, Batter's Box and Pitching Rubbers. Shall be turf inlaid of white color to represent bases, batter's boxes, and pitching rubbers.

F. Infield/Outfield Delineation Line. Shall be turf inlaid of white color and dashed to represent the limit of the infield for both softball and baseball fields.

2.4 DELIVERY, STORAGE, HANDLING AT PROJECT SITE

A. Deliver all materials to the Project site in their original protective packaging, unopened and with the manufacturer's labels intact and legible, indicating brand name and identifying numbers and information, as applicable.

B. Store and handle all materials in strict accordance with the recommendations of the manufacturer of the materials.

C. Protect rolls of synthetic turf from getting wet while in storage.

PART 3 SUBMITTALS

3.1 Turf Contractor/Installer - The following items shall be submitted with the Proposal Form.

A. Identify trade name or by manufacturer's name the proposed items to be installed.

01 Manufacturer's technical specification for synthetic turf and under pad with a laboratory test supporting the technical specifications.

02 Manufacturer's technical specification for all adhesives, stating where each type of adhesive is to be applied.

03 Sketches of recommended optional details at no increase in contract cost and which differ from those shown on the drawings.

04 Manufacturer's manual for care and maintenance of the turf system and a list of product accessories or other items of service to be included with Turf Contractor/Installer warranty.

05 List of the service equipment deemed necessary for complete use and maintenance of the synthetic turf system. Describe each equipment item by function, names of recommended manufacturers, product names and model numbers, standard features and recommended accessories, current prices and sources of supply.

06 Copy of Turf Contractor/Installer's warranty.

07 Submit a list of the 10 latest outdoor installations of NCAA full size fields where the proposed infill synthetic has been installed. Provide name of Athletic Director, Maintenance Director, phone numbers and location of the installation.

08 Submit 12" x 12" sample of turf product without infill material.

09 Submit 1/2-pint sample of infill sand material if applicable.

10 Submit 1/2-pint sample of rubber granule and synthetic cooling infill material.

11 List of Subcontractor's Turf Contractor/Installer will use.

3.2 TURF CONTRACTOR/INSTALLER SUBMITTALS AFTER CONTRACT AWARD

A. Submit shop drawings showing seaming plan for entire installation.

B. Submit shop drawing showing line striping, marking plan and custom logos.

C. Submit certificate, signed by the infilled Synthetic Turf Contractor/Installer stating the synthetic turf work, including every component, complies with the requirements of the Contract Documents and that the installation methods were adequate and proper for the conditions of installation and use.

D. Submit 3 copies of a manual describing the materials, devices, and procedures to be followed for the use and maintenance of the artificial turf system, including the cleaning and paint application. Furnish training sessions, not less than 2 hours total, to instruct and train the Owner's personnel in operation and maintenance of the artificial turf system and all related equipment.

E. Submit the warranty for the infilled synthetic turf system.

PART 4 EXECUTION

4.1 INSTALLATION OF TURF

A. Except where more stringent requirements are indicated, all materials shall be installed in accordance with the final approved shop drawings, the manufacturer's current printed instructions and recommendations, and as required to obtain the manufacturer's warranty.

B. The turf systems must be satisfactorily restrained at the perimeters to prevent movement of the system. Use non-corrosive staples, nails or screws installed at 6-inch centers to restrain the turf at the edge. The edge detail to restrain the system shall be as shown on the shop drawings.

C. Side seams in the turf fabric shall be at no less than 15'-0" intervals. There shall be no cross or head seams in a panel of turf in the field of play. All seams shall be either sewn with a double locked stitch or glued using reinforcing fabric to strengthen the seam.

4.2 FIELD STRIPING

4.2.1 Football Field

All field markings shall be inlaid. Markings shall be in accordance with the latest edition National Collegiate Athletic Association (NCAA) rules for football. Turf Contractor/Installer shall submit shop drawings showing line striping and marking

plan. Turf Contractor/Installer shall obtain approval of plan prior to striping the field. Owner will select all optional colors not set by NCAA rules.

4.2.2 Soccer Field

All soccer lines shall be inlaid/tufted yellow. All interior soccer field markings and lines shall be inlaid/tufted yellow (verify with Owner). Markings shall be in accordance with the latest edition National Collegiate Athletic Association (NCAA) rules for soccer.

4.2.3 Softball & Baseball Layout

All softball & baseball markings & linework shall be inlaid/tufted white. Markings shall be in accordance with the latest edition National Collegiate Athletic Association (NCAA) rules for softball & baseball.

4.3 WARRANTY

A. The Turf Contractor/Installer shall submit to the Owner the manufacturer's warranty which guarantees the usability, playability, and uniform green color of the synthetic turf system for its intended uses for a minimum 8-year warranty for workmanship and for wear and resiliency. The warranty period shall commence with the date of substantial completion. The warranty coverage shall not be prorated nor limited by the amount of usage.

B. The weight of pile fiber above the original line of infill material shall not decrease more than 5% per year during the 8-year warranty period. Resiliency, Gmax, shall not exceed 110 G's upon installation and shall not exceed a maximum 200 G's during the 8-year warranty period. Any incremental increase in Gmax shall not exceed 20 G's per any single year period. Multiple tests at different locations on the turf system shall not be averaged to determine loss of pile weight or resiliency of the turf system. Each independent test will determine the condition of the turf where the test was made and if replacement of the turf at that location is necessary to meet the warranty requirements. Replacement of warranty items including removal and replacement shall be at the sole expense of the Turf Contractor/Installer.

C. The turf system shall vertically drain a minimum of 10-inches of precipitation per hour without visible surface ponding for the 8-year warranty period.

D. Turf system shall be capable of withstanding a long-term static loading of 300 lbs./S.F. and a maximum dynamic load of 35 psi without damaging the turf system.

E. All warranty items and resolutions shall be governed by the Laws of the State of Texas.

END OF SECTION

SECTION 32 18 31

SYNTHETIC AGGREGATE DRAINAGE BLANKET

PART 1 G E N E R A L

1.1 SCOPE

A. The section specifies the installation of an aggregate or stone drainage blanket under a rubber filled synthetic turf material to facilitate the removal of water.

1.2 RELATED WORK

A. Division 2, Site Work.

1. 32 18 32 Geomembrane Liner.

1.3 QUALITY CONTROL

A. The Turf Contractor shall use an independent testing laboratory selected by the Owner to provide testing of selected aggregate or stone to be used in the drainage blanket.

1.4 SUBMITTALS

A. Submit at a minimum, a 2-gallon container of aggregate or stone to be tested. Additional material shall be submitted if so, requested by the Testing Laboratory in order to complete their test.

1.5 DELIVERY, STORAGE AND HANDLING

A. Aggregate blanket material shall be delivered to the site by truck. Material used for placement around the subdrain system can be temporarily stored on a hard surface that has been cleaned to prevent contamination of the blanket material. Material used for placement on the subgrade shall be delivered and back dumped onto the subgrade such that the delivery truck is not traveling on the subgrade. The blanket material will be pushed onto the subgrade by track mounted tractor working off previously placed material. Turf Contractor shall sequence delivery of the blanket material to minimize storage of the material.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Aggregate Blanket.

1. Drainage blanket material shall consist of clean washed gravel or crushed stone. Soft limestone or other soft materials are not acceptable. Blanket material shall not lose more than 12% by weight when tested for weathering stability using ASTM C-88 sodium sulfate soundness test. The material shall be tested by the L.A. Abrasion test, ASTM C-131, with a percentage lost by weight not exceeding 40.

2. Drainage blanket material shall have the following gradation as a guide for the final selection of material:

Sieve Size	Percent Passing	
	Base Stone	Finishing Stone
2”	100	
1 1/2”	90-100	
1”	75-100	
3/4”	65-95	
1/2”	55-85	100
3/8”	40-75	85-100
1/4”	25-65	75-100
#4	15-60	60-90
#8	0-40	35-75
#16	0-20	10-55
#30	0-7	0-40
#60	0-5	0-15
#100	0-3	0-8
#200	0-2	0-2

3. The blanket material shall be checked for the following:

Structural stability: $D60/D10 > 5$ and $1 < \frac{D\ /30}{D10\ D60} < 3$

Fragmentation must be 100%

Separation of both stones: $\frac{\text{D85 of finishing stone}}{\text{D15 of base stone}} > 2$

And $3 < \frac{\text{D50 of base stone}}{\text{D50 of finishing stone}} < 6$

Drainage:
- Permeability of base stone > 600 in/hr. (0.42 cm/sec.)
- Permeability of finishing stone > 150 in/hr. (0.106 cm/sec.)
- Porosity of both stones > 25%

(when stone is saturated and compacted to 95% max. density)

Depending on the type of aggregate or stone present in the mix, other mechanical characteristics might be necessary for approval.

4. The final design and installation of the aggregate drainage blanket shall be the sole responsibility of the synthetic turf manufacturer/installer.

PART 3 E X E C U T I O N

3.1 SUBDRAINS

A. The Contractor will layout and execute all the trenches for the storm sewer system on the perimeter of the field. The trenches shall be excavated to proper width and grade

to allow for the placement of geomembrane liner and aggregate material in the trench. All excavated material for the storm sewer system shall be removed and the subgrade shall be cleaned, graded, and amended as required to maintain the design elevations of the subgrade.

3.2 GEOMEMBRANE LINER

A. Geomembrane liner shall be installed the length of the playing field. The liner shall drape down into and through the subdrain trench. End seams will not be allowed in the trenches. Place liner in trench so that fabric at a higher elevation overlaps liner at a lower elevation to prevent free water from running underneath the liner in the event of a tear or hole.

B. Install geomembrane liner in accordance with Section 32 18 32.

3.3 AGGREGATE DRAINAGE TRENCHES

A. After geomembrane liner is in place, place initial drainage aggregate in the perimeter storm sewer trench and then place the perforated storm sewer pipe to design grade and alignment.

B. After storm sewer pipe is in place and has been approved by Owner's Representative, Contractor shall place drainage aggregate around the sides of the pipe and continue to fill the trench with aggregate up to 6" of the elevation of the subgrade.

C. After trenches are filled, install composite drains on top of the geomembrane liner in a pattern as shown on the drawings. Drape composite drain into storm sewer trench.

3.4 AGGREGATE DRAINAGE BLANKET

A. Turf Contractor shall install and be responsible for the installation of the aggregate drainage blanket.

B. Turf Contractor shall inspect surface of geomembrane liner to make sure there are no irregularities in surface elevation and that the surface is free of any debris.

C. Aggregate for the drainage blanket shall be back dumped onto the liner so as to keep the delivery trucks off the liner. Turf Contractor shall use a track mounted tractor to push the aggregate over the field.

D. Aggregate blanket shall vary in thickness from 8" at the centerline of the field to a minimum of 12" at the storm sewers. The aggregate blanket will be graded with a fully automated hydraulic actuated maintainer or tractor. Electronic control equipment shall be either Spectr-Physics Corp. or Top-Con equipment.

E. The aggregate blanket shall be reviewed by the Owner's Representative before the Turf Contractor is allowed to install the synthetic turf.

3.5 DISPOSAL OF WASTE MATERIAL

A. All excess excavated material, debris or other objectionable material shall become the property of the Turf Contractor and shall be removed from the project site and legally disposed of at no cost to the Owner.

END OF SECTION 32 18 31

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SECTION 32 18 32

GEOMEMBRANE LINER

PART 1 G E N E R A L

1.1 WORK INCLUDED

A. This section specifies requirements for the installation of a Very Flexible Polyethylene (VFPE) geomembrane liner.

1.2 RELATED WORK

A. Division 2 - Sitework.

1. 32 18 31 - Aggregate Drainage Blanket.

1.3 REFERENCES

A. Test procedures and equipment shall comply with applicable standard test methods of the American Society of Testing and Materials (ASTM), Federal Test Method Standards and NSF International Standards.

1.4 SUBMITTALS - Post Award

A. Certify geomembrane manufacturer is listed by NSF International.

B. Geomembrane Roll

1. Certification stating the resin meets specifications contained herein.

2. Certification all resin is from the same manufacturer.

3. Quality Assurance/Quality Control certificates issued by geomembrane manufacturer and resin supplier.

C. Certification extrudate resin and or rod is from one manufacturer, is the same resin type and was obtained from the same resin supplier as the resin used to manufacture the geomembrane rolls.

D. Shop drawings showing proposed panel layout including field seams and details.

E. Installer Geosynthetic Field Installation Quality Assurance Plan.

F. Subgrade acceptance forms before placement of geomembrane rolls.

G. Certificate stating the geomembrane has been installed in accordance with the Contract Documents.

H. Material and installation warranties.

I. As-Built drawings showing actual geomembrane panel placement and seams.

1.5 QUALIFICATIONS

A. Manufacturer.

1. Geomembrane shall be manufactured by GSE Lining Technology, Inc. or an approved alternate manufacturer.

2. The manufacturer shall have manufactured a minimum of 10,000,000 S.F. of HDPE geomembrane during the last year.

B. Installer.

1. Installation shall be installed by authorized subsidiary or dealer of the manufacturer.

C. The Installer shall have worked in a similar capacity on at least 3 projects similar in complexity to the project described in the contract documents, and with at least 90,000 square feet of HDPE geomembrane installation on each project.

D. The Installation Supervisor shall have worked in a similar capacity on projects similar in size and complexity to the project described in the Contract Documents.

E. The Master Welder shall have completed a minimum of 1,000,000 square feet of geomembrane seaming work using the type of seaming apparatus proposed for use on this Project.

PART 2 P R O D U C T S

2.1 MATERIAL LABELING, DELIVERY, STORAGE AND HANDLING

A. Labeling. Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label shall clearly state the manufacturer's name, product identification, thickness, length, width and roll number. The label shall be found on either of the endcaps, an inside edge of the core, and outside the core.

B. Delivery. The rolls of the liner shall be packaged and shipped by appropriate means to prevent damage to the material and to facilitate off-loading. Off-loading and storage of the geomembrane is the responsibility of the Contractor. The Contractor shall be responsible for replacing any damaged or unacceptable material at no cost to the Owner. No off-loading shall be done unless the engineer is present. Damage during off-loading shall be documented by the Engineer. All damaged rolls or bundles must be separated from the undamaged rolls or bundles until the proper disposition of that material has been determined by the Engineer. The Engineer will be the final authority on determination of damage and disposition.

C. Storage. The on-site storage location for geomembrane material shall be level, smooth, elevated, and dry (not wooden pallets). The storage place shall be protected from theft and vandalism and shall be adjacent to the area to be lined. The Contractor shall provide a suitable storage site which will protect the geomembrane from punctures, abrasions, excessive moisture, and dirt.

D. Handling. The materials are to be handled to prevent damage. Instructions for moving geomembrane rolls shall be provided by the Manufacturer upon request.

2.2 MATERIALS

A. Geomembrane. Smooth 30 mil thick very flexible polyethylene (VFPE).

B. Resin. Resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane. Resin types shall not be intermixed. Natural resin, without carbon black shall meet the following requirements:

Density (g/cm)	0.915-0.920
OIT (minutes)	100

C. Geomembrane Rolls. Geomembrane shall not exceed a combined maximum total of 1% by weight of additives other than carbon black. Geomembrane shall be free of holes, pinholes, bubbles, blisters, excessive contamination by foreign matter and nicks and cuts on roll edges. Geomembrane shall meet the following requirements:

Property	Test Data
Minimum Thickness (Mil)	30
Density (g/cm)	0.920
Carbon Black Content (%)	2.0
Carbon Black Dispersion	A2
Tensile Properties (ea. direction)	
Strength @ Break (lb.in.)	122
Elongation (%)	780
Tear Resistance (lb.)	18
Puncture Resistance (lb.)	40
ESCR (hours)	l,500
Dimensional Stability (% change)	2

D. Extrudate Rod or Bead. Extrudate material shall be made from the same type of resin as the geomembrane. Additives shall be thoroughly dispersed. Extrudate shall be free of contamination by moisture or foreign matter.

E. Geomembrane Retainer. Provide continuous 3” x 2” x 3/16” galvanized steel angle bracket. Fasten to concrete pavement with 1/2” x 3” stud bolts or set bolts w/nut and washer. Bolts are located as shown on drawings. A continuous 2” x 6” Redwood nailer may be used in lieu of galvanized steel angle bracket. Bolts or fasteners shall be located as shown on drawings. Field Preparation Contractor shall install the nailer preferred by the Turf Contractor.

F. Water Cut-off Mastic. Poly-Flex neoprene flashing cement by Poly-America, Inc. or a 3/16” x 2” compressible neoprene gasket joint sealer. Flashing cement or compressible neoprene gasket and the geomembrane are installed behind the retainer.

2.3 EQUIPMENT

A. Provide the equipment and tools necessary to obtain the specified results.

PART 3 E X E C U T I O N

3.1 SUPERVISION

A. During installation of geomembrane liner, Contractor shall have an Installation Supervisor at the site. The Installation Supervisor shall have had previous experience in installing geomembranes on at least 3 other projects where the installation was equivalent to this

project.

3.2 GEOMEMBRANE INSTALLATION

A. Subgrade Inspection. Prior to installation of geomembrane liner, Contractor's installer shall inspect the subgrade to receive the geomembrane. The subgrade surface shall be smooth, free of sharp objects or debris of any kind. The subgrade surface shall be checked for grade in conformance with the grading plan to facilitate rainfall runoff. The Contractor shall certify daily that the surface on which the geomembrane will be installed is acceptable for installation of the geomembrane.

B. Weather Conditions. Geomembrane placement shall not be done during any precipitation, wet subgrade or excessive wind.

C. Method of Installation.

1. Contractor's Responsibility.

a. Use equipment and tools that will not damage the geomembrane.

b. All personnel working on geomembrane installation will not be allowed to smoke, wear damaging shoes or engage in any activity that may damage the geomembrane.

c. The method used to unroll the panels shall not scratch or crimp the geomembrane or disturb the supporting subgrade.

d. The method used to place the panels shall minimize wrinkles.

e. Provide sufficient material (slack) to allow for geomembrane expansion and contraction.

f. Provide adequate number of sand bags to prevent uplift by the wind.

g. Direct contact with the geomembrane once in place shall be minimized.

2. Install the geomembrane panels from one side of the field to the other in one continuous operation. Installation shall start at the end of the field that will offer the best advantage from the wind. Install the panels so as to provide a 24-inch wide overlap at the seam.

D. Field Seaming.

1. Seam Orientation. Seams shall be oriented parallel to the line of maximum slope and not across the slope. In corners, the number of seams shall be minimized. T-seams will not be allowed. Align seams with the least possible number of wrinkles and "fishmouths". Wrinkles and fishmouths if present shall be capstripped.

2. Seam Welding.

a. At least one Master Welder shall provide supervision over other welders on the project.

b. Extrusion Welding. Hot-air bond adjacent pieces together using procedures that do no damage geomembrane. Purge welding apparatus of heat-degraded extrudate before welding. Clean geomembrane surfaces by disc grinder or equivalent.

c. Hot Wedge Welding. Welding apparatus shall be a self-propelled device with an electronic controller which displays applicable temperatures. Protect against moisture build-up between sheets. Clean seam area of dust, mud, moisture and debris immediately ahead of the hot wedge welder.

d. Trial Welds. Trial welds shall be performed on geomembrane samples to verify welding equipment is operating properly. No welding equipment or welder shall be allowed to perform production welds until equipment and welders have successfully completed trial weld. Minimum of two trial welds per day, per welding apparatus, one made prior to the start of work and one completed at mid shift. Make trial welds under the same surface and environmental conditions as the production welds, i.e., in contact with subgrade and similar ambient temperature. Cut four, one-inch wide by six-inch long test strips from the trial weld. Quantitatively test specimens for peel adhesion, and then for bonded seam strength (shear). A trial weld specimen shall pass when the following results are achieved in both peel and shear test.

Property	Test Data
Peel Strength (ppi)	36
Shear Strength (ppi)	40

Repeat the trial weld, in its entirety, when any of the trial weld samples fail in either peel or shear.

3. Weather Conditions. Seaming shall not proceed when ambient air temperatures or adverse weather conditions jeopardize the integrity of the liner installation. Installer shall demonstrate that acceptable seaming can be performed by completing acceptable trail welds.

4. Defects and Repairs. Examine all seams and non-seam areas of the geomembrane for defects, holes, blister, undispersed raw materials, and any sign of contamination by foreign matter. Repair and non-destructively test each suspect location in both seam and non-seam areas. Do not cover geomembrane at locations which have been repaired until test results with passing values are available.

E. Geomembrane Retainer. After geomembrane panels have been seamed and the geomembrane stretched and in place, apply neoprene flashing cement or gasket to concrete pavement around the perimeter of the field and attach geomembrane. Install angle bracket and bolt into place.

F. Field Quality Assurance.

1. The Manufacturer, Fabricator and Installer shall participate in and conform with all terms and requirements of the Owner's quality assurance program. The Contractor shall be responsible for assuring this participation. Quality assurance requirements are as specified in this Section.

2. Field Testing.

a. Non-destructively test all field seams over their full length using a vacuum test unit, air pressure (for double fusion seams only), or other approved methods. Non-destructive testing may be carried out as the seaming progresses or at completion of all field seaming.

G. Failed Seam Repair. Installer shall reconstruct the seam between any two passed test locations.

H. Repair Procedures.

1. Remove damaged geomembrane and replace with acceptable geomembrane materials if damage cannot be satisfactorily repaired.

2. Repair any portion of unsatisfactory geomembrane or seam area failing test. The installer shall be responsible for repair of damaged or defective areas. Agreement upon the appropriate repair method shall be decided between the Engineer and the Installer. Procedures available include the following:

a. Patching - Used to repair large holes, tears, undispersed raw materials and contamination by foreign matter.

b. Abrading and Re-welding - Used to repair small seam sections.

c. Spot Welding - Used to repair pinholes or other minor, localized flaws or where geomembrane thickness has been reduced.

d. Capping - Used to repair large lengths of failed seam.

e. Flap Welding - Used to extrusion weld the flap (excess outer portion) a fusion weld in lieu of a full cap.

f. Removing the unacceptable seam and replace with new material.

3. In addition, the following procedures shall be observed:

a. Surfaces of the polyethylene which are to be repaired by extrusion welds shall be lightly abraded to assure cleanliness.

b. All geomembrane surfaces shall be clean and dry at the time of repair.

c. Extend patches or caps at least 6 inches for extrusion weld and 4 inches for wedge weld beyond the edge of the defect, and round all corners of patch material.

4. Repair Verification. Non-destructively test each repair.

PART 4 W A R R A N T Y

A. The material shall be warranted, on a non-pro-rata basis against manufacturer's defects for a period of 5 years from the date of geomembrane completion.

B. The installation shall be warranted against defects in workmanship for a period of 1 year from the date of geomembrane installation.

END OF SECTION 32 18 32

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SECTION 32 18 33

STORM SEWERS, SUBDRAINS AND DRAINS FOR PLAYING FIELD

PART 1 GENERAL

1.1 SCOPE

A. This section provides for furnishing and constructing storm sewers, subdrains and drains for synthetic turf playing field.

1.2 RELATED WORK

A. Division 2, Site Work

(1) 32 18 31 – Synthetic Turf Aggregate Drainage Blanket.

(2) 32 18 32- Geomembrane Liner.

1.3 QUALITY ASSURANCE

A. Field Preparation Contractor shall be responsible for supervision, inspection and providing samples of materials for test and approval by others.

B. Field Preparation Contractor shall have a Superintendent to direct the installation of the drainage system.

1.4 SUBMITTALS

A. Field Preparation Contractor shall submit product data samples and supporting literature for all drainage pipe and fixtures.

PART 2 PRODUCTS

2.1 STORM SEWER, SUBDRAIN AND DRAIN PIPE

A. Storm Sewer Pipe.

(1) Polyethylene Pipe. The pipe shall be manufactured in accordance with the most recent AASHTO M-294 Type S or SP specification. The conduit shall be constructed of high density polyethylene.

The pipe shall be seamless with annular corrugations on the exterior and a smooth interior waterway. Minimum stiffness valve shall be 34 (pii @ 5% deflection).

Pipe shall be ADS N-12 ProLink ULTRA as manufactured by Advanced Drainage Systems, Inc. or Hancor Hi-Q TiteLine as manufactured by Hancor, Inc.

(2) PVC Pipe. Polyvinyl chloride pipe shall be manufactured in accordance with ASTM F679 except to provide wall thickness as required for SDR-26 and pipe strength of 160 psi. The pipe shall be seamless and solid wall construction.

B. Subdrain Pipe. Double wall polyethylene subdrain pipe meeting requirements of AASHTO M-252. The pipe shall be ADS N-12 of the nominal pipe size shown on drawings and manufactured by Advanced Drainage Systems, Inc. or approved alternate. Four inch through 8 inch subdrain pipe shall have slot perforations and shall be wrapped in drain guard filter cloth. Subdrain pipe 12" and larger shall have "D" perforation configuration and shall be wrapped in "Drain Guard" geotextile filter cloth sock.

C. Drain Pipe. Polyvinyl chloride pipe meeting requirements of ASTM D-3034. The pipe shall be of SDR-26 of the nominal pipe size shown on drawings.

D. Composite Drain. Composite drains shall be Enkaturf Drain 9323 by Colbond Geosynthetics or an approved alternate. Turf Contractor shall install composite drains.

2.2 PIPE JOINT MATERIAL

A. PE Gasketed Joints. For all polyethylene pipe provide rubber gasketed joints compatible with ADS N-12 and Hancor Hi-Q pipe.

B. PVC Gasket Joints. Joint shall be factory premolded compression type, vulcanized, high grade elastomeric compound joint. Joints shall meet or exceed the requirements of ASTM D-3212. Fittings shall be made with an integral bell utilizing a gasket for sealing which meets specifications defined in ASTM F-477.

3.0 EXECUTION

3.1 EXCAVATION

A. Excavate trenches for pipe to alignment and size as shown on the drawings. A ladder or wheel type excavator is preferred for the subdrain lines to provide clean vertical walls to the trench.

B. Field Preparation Contractor shall use a laser instrument to set and maintain design slope and invert elevation of the pipe.

3.2 PIPE BEDDING

A. Subdrains. Bottom of trench will be shaped to provide uniform 2" thickness of drainage gravel under the pipe so that pipe will have full bearing to design grade and elevation.

B. Storm Drains. Bottom of trench shall be shaped to provide uniform bearing for the pipe.

3.3 PIPE INSTALLATION

A. Playing Field.

(1) Storm Sewers, Subdrains and Drains. Furnish and place in position, as directed, all necessary stakes, grade and batter boards for locating work. Do not place pipe until the excavation has been completed, the bottom of the trench shaped, proper bedding material placed and approval by the Owner's Representative for condition, line and grade has been obtained. Lay pipe accurately to line and grade in a straight line with spigot or tongue end of the pipe pointing in the direction of flow. Fit pipes together and

match them so that when laid, the pipe will form a sewer or subdrain with a smooth and uniform invert.

B. Drain Pipe. All PVC drain pipe shall be connected to subdrain pipe and storm sewer pipe with fittings. Filter cloth on subdrain pipe shall be secured around fitting to prevent piping of drainage blanket material.

C. Change in Pipe Sizes. Connection between subdrain pipe of different diameters shall be by inverted reducers installed so the crowns of the two pipes are at equal elevations.

D. Penetration of Liner. All pipe penetration of the geomembrane liner by drainage pipe shall require flange fittings of the size pipe penetrating the liner to seal and secure the liner from leaking water into the surrounding subgrade.

3.4 BACKFILL

A. Storm Sewers and Drains. Backfill the trench in accordance with details shown on the drawings.

B. Subdrains. Backfill the trench in accordance with details shown on the drawings.

END OF SECTION 32 18 33

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SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Galvanized steel chain link fences.
2. Manual swinging personnel gates.
3. Motorized and manual vehicle cantilever sliding gates with access control.
4. Heavy duty vehicle gate operator.

B. Related Sections:
1. Section 03 30 00 - Cast-in-place Concrete
2. Section 32 31 19 - Decorative Metal Fences and Gates

C. References:
1. UL 325 Safety Standard.

1.2 SUBMITTALS

A. General: Submit shop drawings, product data, and manufacturer's installation instructions in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Include plan layout, spacing of components, accessories, fittings, hardware, anchorages, and schedule of components.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide chain link fences and gates as manufactured by one of the following:
Allied Tube & Conduit (Div. of Atkore International, Inc.)
Anchor Fence, Inc.
General Wire & Supply Co.
Master Halco, Inc.
Merchants Metals, Inc. (Div. of Oldcastle Building Products, Inc.)
Southwestern Wire, Inc.

2.2 MATERIALS

A. Steel Fabric: Comply with Chain Link Fence Manufacturers Institute (CLFMI) Product Manual. Furnish one-piece fabric widths for fencing up to 12 feet high. All fencing shall have a knuckled selvage top and bottom. Wire size includes zinc coating. Provide 2-inch mesh, 9-gage (0.148-inch diameter) wire, typical.

B. Galvanized Steel Finish: ASTM A 392, Class 1, with not less than 1.2 oz. zinc per sq. ft. of uncoated wire surface.

C. Framing: Strength requirements for posts and rails shall comply with ASTM F 1043.

D. Pipe shall be straight, true to section, material, and sizes specified, and shall conform to the following weights per foot:

NPS in inches	Outside Diameter (OD) in inches	Type I Steel	Type II Steel
1-1/4	1.660	2.27	1.84
1-1/2	1.900	2.72	2.28
2	2.375	3.65	3.12
2-1/2	2.875	5.79	4.64
3-1/2	4.000	9.11	6.56

E. Steel Framework, General: Posts, rails, braces, and gate frames.
   1. Type I Pipe: Hot-dipped galvanized steel pipe conforming to ASTM F 1083, plain ends, standard weight (schedule 40) with not less than 1.8 oz. zinc per sq. ft. of surface area coated.
   2. Type II Pipe: Manufactured from steel conforming to ASTM A 569 or A 446, grade D, cold formed, electric welded with minimum yield strength of 50,000 psi and triple coated with minimum 0.9 oz. zinc per sq. ft. after welding, a chromate conversion coating and a clear polymer overcoat. Corrosion protection on inside surfaces shall protect the metal from corrosion when subjected to the salt spray test of ASTM B 117 for 300 hours with the end point of 5 percent Red Rust.

F. End, corner, and pull posts: 2.875-inch OD Type I or II steel pipe.

G. Line or intermediate posts: 2.375-inch OD Type I or II steel pipe.

H. Top Rail: Manufacturer's longest lengths, with expansion-type couplings, approximately 6 inches long, for each joint. Provide means for attaching top rail securely to each gate corner, pull, and end post.
   1. Galvanized Steel: 1-1/4-inch NPS (1.66-inch OD) Type I or II steel pipe.

I. Tension Wire: ASTM A 824, 0.177-inch-diameter metallic-coated steel marcelled tension wire with finish to match fabric.

J. Tie Wires: 12-gauge (0.106-inch diameter) galvanized steel with a minimum of 0.80 oz. per sq. ft. of zinc coating of surface area in accordance with ASTM A 641, Class 3.

K. Post and Line Caps: Provide weathertight closure cap for each post. Provide line post caps with loop to receive tension wire or top rail.

L. Tension or Stretcher Bars: Hot-dip galvanized steel with minimum length 2 inches less than full height of fabric, minimum cross-section of 3/16 inch by 3/4 inch and minimum 1.2 oz. zinc coating per sq. ft. of surface area. Provide one bar for each gate and end post, and two for each corner and pull post, except where fabric is integrally woven into post.

M. Tension and Brace Bands: Minimum 3/4-inch-wide hot-dip galvanized steel with minimum 1.2 oz. zinc coating per sq. ft. of surface area.
   1. Tension and Brace Bands: Minimum 12 gage (0.105 inch) thick.

N. Gates:
   1. 1.990 in. o.d. galvanized pipe frames, welded construction.
   2. 1.660 in. o.d. pipe internal bracing.
   3. Standard-type hinges, heavy malleable iron, constructed to allow gate to swing 90 deg. or 180 deg.
   4. Provide fork latch with padlocking device.

2.3 HORIZONTAL-SLIDE GATES

A. General: Comply with ASTM F 1184 for gate posts and single sliding gate types.
   1. Classification: Type I Overhead Slide.
      a. Gate Leaf Width: As shown on drawings.
      b. Gate Height: As shown on drawings

B. Pipe and Tubing:
   1. Zinc-Coated Steel: Protective coating and finish to match fence framing.
   2. Aluminum: Comply with ASTM B 429; mill finish.
   3. Gate Post Size and Weight: Not less than required by ASTM F 1916.

C. Frame Corner Construction: Welded and 3/8-inch-diameter, adjustable truss rods for panels.

D. Hardware: Hangers, roller assemblies, and stops fabricated from mill-finished Grade 319 aluminum-alloy casting with stainless-steel fasteners.

E. Horizontal-Slide Gate:
   1. Operator:
      a. Right angle gearhead, instantly reversing motor with magnetic drum-type brake, friction disc clutch, reversing starter, thermal overload protection, and a chain-driven geared rotary-type automatic limit switch.

1) Gears: Hardened steel machine cut worm and mating bronze gear.
2) All gears and bearings shall operate in a bath of oil.

b. Gate operators with V-belt pulleys are not allowed.
c. Electric Motors:
1) U.L. listed, continuous duty rated, free wheeling hydraulic.
2) Single direction high starting torque type.
3) Internal overload protection and manual reset override protection.
4) Include electrical disconnect switch at control box.
d. Equip gate operators with an emergency release mechanism to allow gates to be operated manually and locked in the engaged or disengaged position.
e. Hydraulic Pump Capacity: Minimum 3 gallon per minute.
f. Operator Housing: Minimum 14 gage, painted galvanized steel.
g. Limit Switches: NEMA size “0", readily adjustable. Provide positive stops on the gate tracks as a backup to the limit switches.

2. Internal Timer: Limit run time of operator to a maximum of 90 seconds in any one direction. Include ability to hold gates in fully open position for an indefinite time.
3. Reversal of Gate from an Open or Reverse Device: 1.5 second delay.
4. Gate Opening:
a. Pedestal mounted keypad opens gate to fully open position. Activation of keypad while gate is closing shall stop gate and reverse gate travel to fully open position.
b. Traffic loop in paving on secure side of gate opens gate to fully open position: Extend loop across entire width of driveway, less 2 feet maximum on each side. Activation of traffic loop while gate is closing shall stop gate and reverse gate travel to fully open position.
5. Gate Closing:
a. Adjustable Timer Module: Gate automatically closes after a preset time after reaching fully open position.
b. Provide safety impact reverse device for each gate leaf to automatically reverse gate travel to fully open position upon striking an object in the path of travel.
6. Operator Control Circuit: Provide signal output to a remote location if gate does not reach fully closed position within 90 seconds (adjustable) of operation. Provide empty underground conduit with pull string from each gate operator to a location inside the building, exact location to be determined.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Install fence in compliance with ASTM F 567. Do not begin installation and erection before final grading is completed.

B. Setting Posts: Set posts in concrete footing as detailed. Space maximum 10 feet o.c. Check each post for vertical and top alignment and hold in position during placement and finishing operations.

C. Top Rails: Run rail continuously through line post caps, bending to radius for curved runs and at other posts terminating into rail end attached to posts or post caps fabricated to receive rail. Provide expansion couplings as recommended by fencing manufacturer.

D. Brace Assemblies: Install braces so posts are plumb when diagonal rod is under proper tension.

E. Bottom Tension Wire: Install tension wire within 6 inches of bottom of fabric before stretching fabric and tie to each post with not less than same gage and type of wire. Pull wire taut, without sags. Fasten fabric to tension wire with 11-gage hog rings of same material and finish as fabric wire, spaced maximum 24 inches o.c.

F. Tension or Stretcher Bars: Thread through or clamp to fabric 4 inches o.c., and secure to end, corner, pull, and gate posts with tension bands spaced not over 15 inches o.c.

G. Tie Wires: Use U-shaped wire of proper length to secure fabric firmly to posts and rails with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing.
1. Maximum Spacing: Tie fabric to line posts 12 inches o.c. and to rails and braces 24 inches o.c.

H. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

3.2 FIELD QUALITY CONTROL

A. Tolerances: Posts shall be straight and plumb within a vertical tolerance of 1/4 inch after the fabric has been stretched.

B. Provide fencing and gates that are true to line with maximum 1/2 inch deviation from the established centerline between line posts.

C. Repair defects as directed.

3.3 ADJUSTING AND CLEANING:

A. Test each gate operator installed to verify proper operation. Make necessary adjustments to provide proper operation to comply with UL 325.

B. Verify that all specified accessory items have been furnished and installed.

END OF SECTION

SECTION 32 31 19

DECORATIVE METAL FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Ornamental metal fencing.

B. Related Sections:
1. Section 31 23 00 - Earthwork.
2. Section 03 33 00 - Cast-In-Place Concrete

1.2 SUBMITTALS

A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data: Include construction details, materials descriptions, dimensions of individual components and profiles, and finishes.

C. Shop Drawings: Show locations of fences, post, rails, and accessories. Include plans, fence elevation, sections, details of post anchorage, and other required installation clearances.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed ornamental metal fences and gates similar in material, design, and extent to those indicated for this project and whose work has resulted in construction with a record of successful in-service performance.

1.4 PRODUCT HANDLING AND STORAGE

A. 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.

1.5 WARRANTY

A. Warrant the work specified herein for 20 years against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials and workmanship. Include a 5 year labor warranty. Defects shall include, but not limited to, the following:
1. Cracking
2. Peeling
3. Blistering
4. Corroding
5. Failure of mechanical parts or assemblies

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Provide Montage II, Majestic, ornamental metal fencing system as manufactured by Ameristar Perimeter Security, (phone 888.333.3422 web site: https://www.ameristarperimeter.com/us/en) or approved equivalent.

2.2 MATERIALS

A. Materials for fence framework (i.e., pickets, rails, and posts) shall be manufactured from coil steel having a minimum yield strength of 50,000 psi. The steel shall be galvanized to meet the requirements of ASTM A 526 with a minimum zinc coating weight of 0.90 ounces per square foot (coating Designation G-90), hot-dip process. Galvanized framework shall be subject to a six stage pretreatment/wash (with zinc phosphate) followed by "PERMACOAT™", an electrostatic spray application of a two-coat powder system. Color shall be as selected by Architect.

B. Material for fence:
   1. Pickets shall be minimum 1” sq x 14 ga. tubing.
   2. Rails shall be 1.75” x 1.75” with a minimum thickness of 12 ga.
   3. Posts shall be 3” sq x 12 ga.
   4. Height as shown in drawings.

2.3 SWING GATES

A. Pedestrian Swing Gates.
   1. Gate Configuration: As indicated.
   2. Galvanized-Steel Frames and Bracing: Fabricate members from square tubes 2 by 2 inches formed from 0.108-inch nominal-thickness, metallic-coated steel sheet or formed from 0.105-inch nominal-thickness steel sheet and hot-dip galvanized after fabrication.
      a. Frame Corner Construction: Welded and 5/16-inch-diameter, adjustable truss rods for panels 5 feet wide or wider.
   3. Infill: Match adjacent fence with the addition of galvanized 3/4" No. 16 Flattened expanded steel mesh.
   4. Hardware:
      a. Exit Device: As indicated on Hardware Schedule.
      b. Hinge/Closer: Integrated hinge-closer set shall be ADA compliant that shall include a variable speed and final snap adjustment mounted with tamper-resistant security fasteners, with full range of adjustability.

2.4 FABRICATION

A. Pickets, rails, and posts shall be precut to specified lengths. Ornamental metal fence shall be factory-fabricated in sections.

B. All components of ornamental metal fence shall be factory finished after fabrication.

PART 3 - EXECUTION

3.1 PREPARATION

A. Stake locations of fence lines and terminal posts. Indicate locations of utilities, lawn sprinkler system, and underground structures.

3.2 INSTALLATION

A. General: Install ornamental metal fences in strict compliance with manufacturer’s written instructions and recommendations.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings as recommended by manufacturer.

C. Post Setting: Set posts in concrete.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete.
   2. Concrete Fill: Place concrete around posts and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter. Extend concrete 2 inches above grade; shape and smooth to shed water.

D. Panels shall be attached to posts using panel brackets and bolt-on hardware supplied by manufacturer.

3.3 CLEANING

A. Contractor shall clean the jobsite of excess materials; post hole excavations shall be scattered uniformly away from posts.

END OF SECTION

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SECTION 32 91 13.13

TOPSOIL PLACEMENT AND GRADING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Furnishing and placing topsoil for finish grading and for seeding, sodding, and planting in areas other than designated athletic fields.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No separate payment will be made for topsoil under this Section. Include payment in related Division 1 work.
2. Refer to Division 1 for unit price procedures.

PART 2 P R O D U C T S

2.1 TOPSOIL

A. Topsoil shall be fertile, friable, natural sandy loam surface soil obtained from excavation or borrow operations having following characteristics:

1. pH value of between 5.5 and 6.5
2. Liquid limit: 50 or less
3. Plasticity index: 20 or less
4. Gradation: maximum of 10 percent passing No. 200 sieve

B. Topsoil shall be reasonably free of subsoil, clay lumps, weeds, non-soil materials, and other litter or contamination. Topsoil shall not contain roots, stumps, and stones larger than 2 inches.

C. Obtain topsoil from naturally well-drained areas where topsoil occurs at minimum depth of 4 inches and has similar characteristics to that found at placement site. Do not obtain topsoil from areas infected with growth of, or reproductive parts of nut grass or other noxious weeds.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Excavate topsoil for esplanades and areas to receive grass or landscaping from areas to be further excavated. Stockpile in area approved by Owner’s Representative.

B. Stockpile topsoil to depth not exceeding 8 feet. Cover to protect from erosion.

3.2 TOPSOIL EXCAVATION

A. Conform to excavation and stockpiling requirements of Division 31.

3.3 PLACEMENT

A. Place no topsoil until subgrade has been approved. For areas to be seeded or sodded, scarify or plow existing material to minimum depth of 4 inches, or as indicated on Drawings. Remove vegetation and foreign inorganic material. Place 4 inches of topsoil on loosened material and roll lightly with appropriate lawn roller to consolidate topsoil.

B. Increase depth of topsoil to 6 inches when placed over sand bedding and backfill materials specified in Division 31.

C. For areas to receive shrubs or trees, excavate existing material and place topsoil to depth and dimensions shown on Drawings.

D. Remove spilled topsoil from curbs, gutters, and, paved areas and dispose of excess topsoil in accordance with requirements of Division 1.

E. Place topsoil to promote good drainage and compact with light roller. Water topsoil after placement until saturated for minimum depth 6 inches, fill in and recompact areas of settlement.

3.4 PROTECTION

A. Protect topsoil from wind and water erosion until planting is completed.

END OF SECTION 32 91 13.13

SECTION 32 92 13

HYDRO-MULCHING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Seeding, fertilizing, mulching, and maintenance in areas other than designated athletic fields.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for hydro mulch seeding is on an acre basis.
2. Refer to Division 1 for unit price procedures.
3. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.3 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit certification from supplier that each type of seed conforms to these specifications and requirements of Texas Seed Law. Certification shall accompany seed delivery.

C. Submit certificate stating that fertilizer complies with these specifications and requirements of Texas Fertilizer Law.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Topsoil: Conform to material requirements of Division 32.

B. Seed: Conform to U.S. Department of Agriculture rules and regulations of Federal Seed Act and Texas Seed Law. Seed shall be certified 90 percent pure and furnish 80 percent germination and meet following requirements:

1. Rye: Fresh, clean, Italian rye grass seed (lollium multi-florum), mixed in labeled proportions. As tested, minimum percentages of impurities and germination must be labeled. Deliver in original unopened containers.
2. Bermuda: Extra-fancy, treated, lawn type common bermuda (Cynodon dactylon). Deliver in original, unopened container showing weight, analysis, name of vendor, and germination test results.
3. Wet, moldy, or otherwise damaged seed will not be accepted.
4. Seed requirements, application rates, and planting dates are:

TYPE	APPLICATION RATE POUNDS/A	PLANTING DATE
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88	40 40	Jan 1 to Mar 31
Hulled Common Bermuda Grass 98/88	40	Apr 1 to Sep 30
Hulled Common Bermuda Grass 98/88 Unhulled Common Bermuda Grass 98/88 Annual Rye Grass (Gulf)	40 40 30	Oct 1 to Dec 31

C. Fertilizer: Dry and free flowing, inorganic, water soluble commercial fertilizer, which is uniform in composition. Deliver in unopened containers which bear manufacturers guaranteed analysis. Caked, damaged, or otherwise unsuitable fertilizer will not be accepted. Fertilizer shall contain minimum percentages of following elements:

1. Nitrogen: 10 Percent
2. Phosphoric Acid: 20 Percent
3. Potash: 10 Percent

D. Mulch:

1. Virgin wood cellulose fibers from whole wood chips having minimum of 20 percent fibers 0.42 inches in length and 0.01 inches in diameter.
2. Cellulose fibers manufactured from recycled newspaper and meeting same fiber content and size as for cellulose fibers from wood chips.
3. Dye mulch green for coverage verification purposes.

E. Soil Stabilizer: "Terra Tack 1" or approved equal.

F. Weed control agent: Pre-emergent herbicide for grass areas, such as "Benefin," or approved equal.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Place and compact topsoil in accordance with requirements of Division 32.

B. Dispose of Objectionable and Waste Materials in accordance with Division 1.

3.2 APPLICATION

A. Seed: Apply uniformly at rates given in Paragraph 2.01 B for type of seed and planting date.

B. Fertilizer: Apply uniformly at rate of 500 pounds per acre.

C. Mulch: Apply uniformly at rate of 50 pounds per 1000 square feet.

D. Soil Stabilizer: Apply uniformly at rate of 40 pounds per acre.

E. Weed Control Agent: Apply at manufacturer's recommended rate prior to hydro mulching.

F. Sod: Lay single row of sod along perimeter where top soil and pavement intersect. Apply in conformance to Division 32.

G. Suspend operations under conditions of drought, excessive moisture, high winds, or extreme or prolonged cold. Obtain Owner's Representative approval before resuming operations.

3.3 MAINTENANCE

A. Maintain grassed areas minimum of 90 days, or as required to establish an acceptable lawn. For areas seeded in fall, continue maintenance following spring until acceptable lawn is established.

B. Maintain grassed areas by watering, fertilizing, weeding, and trimming.

C. Repair areas damaged by erosion by regrading, rolling and replanting.

D. Reseed small, sparse grass areas. When sparse areas exceed 20 percent of planted area, reseed by hydro mulch.

E. Mow grass when height reaches 3 1/2 inches or greater on average before final acceptance. Mow to height of 2 1/2 inches.

END OF SECTION 32 92 13

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SECTION 32 92 23

SODDING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Restoration of existing lawn areas disturbed by construction shall be by installation of new sod in areas other than designated athletic fields.

B. Planting of sod within areas designated on Drawings for purpose of surface stabilization, channel stabilization or vegetation buffer strips.

C. Sod is defined as blocks, squares, strips of turfgrass, and adhering soil used for vegetative planting. To be placed edge to edge for complete coverage.

D. Lawn is defined as ground covered with fine textured grass kept neatly mowed.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for sodding is on square yard basis.
2. Refer to Division 1 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 SUBMITTALS

A. Conform to requirements of Division 1.

1.4 QUALITY ASSURANCE

A. Sod only when weather and soil conditions are deemed by Owner’s Representative to be suitable for proper placement.

B. Water and fertilize new sod.

C. Guarantee sod to be growing 30 days after substantial completion.

D. Maintenance Period:

1. Begin maintenance immediately after each section of grass sod is installed and continue for 30 day period from date of substantial completion.
2. Resod unacceptable areas.
3. Water, fertilize, control disease and insect pests, mow, edge, replace unacceptable materials, and perform other procedures consistent with good horticultural practice to ensure normal, vigorous and healthy growth. Install disease control within guidelines set forth by Structural Pest Control Board of the State of Texas.

E. Notify Owner’s Representative 10 days before end of maintenance period for inspection.

PART 2 P R O D U C T S

2.1 SOD

A. Species: Common Bermuda.

B. Contents: 95 percent permanent grass suitable to climate in which it is to be placed; not more than 5 percent weeds and undesirable grasses; good texture, free from obnoxious grasses, roots, stones and foreign materials.

C. Size: 12 inch wide strips, uniformly 2 inches thick with clean-cut edges.

D. Sod is to be supplied and maintained in healthy condition as evidenced by grass being normal green color.

2.2 FERTILIZER

A. Available nutrient percentage by weight: 12 percent nitrogen, 4 percent phosphoric acid, and 8 percent potash; or 15 percent nitrogen, 5 percent phosphoric acid, and 10 percent potash.

2.3 WEED AND INSECT TREATMENT

A. Provide acceptable treatment to protect sod from weed and insect infestation. Submit treatment method to Owner’s Representative for approval. Install insect and disease control within guidelines set forth by Structural Pest Control Board of the State of Texas.

2.4 WATER

A. Potable, available on-site through Contractor's water trucks. Contractor may use public water when water use is measured through Contractor's meter. Do not use private resident's water.

2.5 BANK SAND

A. Free of clay lumps, roots, grass, salt or other foreign material.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Verify that soil placement and compaction have been satisfactorily completed. Verify that soil is within allowable range of moisture content.

B. Top soil shall be free of weeds and foreign material immediately before sodding.

C. Do not start work until conditions are satisfactory. Do not start work during inclement or impending inclement weather.

D. Rake areas to be sodded smooth, free from unsightly variations, bumps, ridges or depressions.

E. Spread 2 inch layer of bank sand over areas to be sodded prior to planting of sod.

F. Apply fertilizer at rate of 25 pounds per 1000 square feet. Apply after raking soil surface and not more than 48 hours prior to laying sod. Mix thoroughly into upper 2 inches of soil. Lightly water to aid in dissipation of fertilizer.

3.2 APPLICATION

A. Full Sodding: Lay sod with closely fitted joints leaving no voids and with ends of sod strips staggered. Lay sod within 24 hours of harvesting.

B. On slopes 2:1 and steeper, lay sod perpendicular to slope and secure every row with wooden pegs at maximum 2 feet on center. Drive pegs flush with soil portion of sod.

C. Prior to placing sod, on slopes 3:1 or where indicated, place Hold/Gro or Roll Lite or equal over topsoil. Securely anchor in place with posts sunk firmly into ground at maximum 16 feet on center along pitch of slope and equal to width of wire mesh horizontally across slopes.

D. After sod is laid, irrigate thoroughly to secure 6-inch minimum penetration into soil below sod.

E. Tamp and roll sod with approved equipment to eliminate minor irregularities and to form close contact with soil bed immediately after planting and watering. Submit type of tamping and rolling equipment to be used to Owner's Representative for approval, prior to construction.

3.3 MAINTENANCE

A. Watering:

1. Water lawn areas once a day with minimum 1/2 inch water for first 3 weeks after area is sodded.
2. After 3 week period, water twice a week with 3/4 inch of water each time unless comparable amount has been provided by rain.
3. Make weekly inspections to determine moisture content of soil unless soil is in frozen condition.
4. Water in afternoon or at night to enable soil to absorb maximum amount of water with minimum evaporation.

B. Mowing:

1. Mow sod at intervals which will keep grass height from exceeding 3 1/2 inches.
2. Set mower blades at 2 1/2 inches.
3. Do not remove more than one-half of grass leaf surface.
4. Mow sodded areas requiring mowing within 1 month after installation with light-weight rotary type mower. Mow sod only when dry and not in saturated or soft condition.
5. Remove grass clippings during or immediately after mowing.

C. Fertilizer and Pest Control:

1. Evenly spread fertilizer composite at rate of 40 pounds per 5000 square feet or as recommended by manufacturer. Do not place fertilizer until 2 weeks after placement of sod.
2. Restore bare or thin areas by topdressing with mix of 50 percent sharp sand and 50 percent sphagnum peat moss.
3. Apply mixture 1/4 to 1/2 inch thick.

4. Treat areas of heavy weed and insect infestation as recommended by treatment manufacturer.

D. Restrict all traffic from sodded areas until sod is established or for minimum 10 days during growing season. Use wood lath and plastic tape to cordon sodded areas. Maintain tape and lath throughout for minimum 30 days during growing season.

3.4 CLEANUP

A. During course of planting, remove excess and waste materials; keep lawn areas clean and take precautions to avoid damage to existing structures, plants, grass, and streets.

B. Remove barriers, signs, and other Contractor material and equipment from project site at termination of establishment period.

C. Dispose of unused materials and rubbish in accordance with Division 1.

END OF SECTION 32 92 23

SECTION 33 05 13

MANHOLES AND STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Precast concrete manholes for sanitary sewers, storm sewers, and water lines.

B. Precast concrete sanitary sewer manholes with PVC liner where corrosion resistant manholes.

C. Pile-supported concrete foundation used for unstable subgrade treatment for manhole base.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for normal depth manholes, up to 8 feet deep, is on a unit price basis for each manhole installed. Manhole depth is measured from top of cover to sewer invert. Air release manhole depth is measured from top of cover to inside base for air release or vacuum release manholes.
2. Payment for shallow depth manholes is on a unit price basis for each manhole installed. Shallow manholes have a depth of 5 feet or less measured from top of cover to sewer invert.
3. Payment for extra depth manholes is on a unit price basis per vertical foot for each foot of depth greater than 8 feet. Sewer manhole depth is measured from top of cover to sewer invert.
4. No separate payment for internal or external manhole drops.
5. Payment for pile-supported concrete foundation used for unstable subgrade treatment for manhole base is on a unit price basis for each foundation installed.
6. Refer to the provisions of Division 1 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. ASME B 16.1 -Cast Iron Pipe Flanges and Flanged Fittings

B. ASTM A 307 -Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile

C. ASTM A 615 -Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. ASTM C 270-Standard Specification for Mortar for Unit Masonry

E. ASTM C 443 -Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

F. ASTM C 478 -Standard Specification for Precast Reinforced Concrete Manhole Sections

G. ASTM C 923 -Standard Specifications for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes

H. ASTM C 1107 -Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)

I. ASTM D 698 -Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-Ib/fr')

J. ASTM D 2665 -Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste and Vent Pipe and Fittings

K. ASTM D 2996 -Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

L. ASTM D 2997 -Standard Specification for Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe

M. AWWA C 213 -Standard for Fusion Bonded Epoxy Coating for Interior and Exterior of Steel Water Pipelines

N. American Association of State Highway and Transportation Officials (AASHTO)

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's data and details of following items for approval:

1. Shop drawings of manhole sections, base units and construction details, including reinforcement, jointing methods, materials and dimensions.
2. Summary of criteria used in manhole design including, as minimum, material properties, loadings, load combinations, and dimensions assumed. Include certification from manufacturer that precast manhole design is in full accordance with ASTM C 478 and design criteria as established in Paragraph 2.01E of this Specification.
3. Frames, grates, rings, and covers
4. Materials to be used in fabricating drop connections
5. Materials to be used for pipe connections at manhole walls
6. Materials to be used for stubs and stub plugs, if required
7. Materials and procedures for corrosion-resistant liner and coatings, if required.
8. Plugs to be used for sanitary sewer hydrostatic testing
9. Manufacturer's data for pre-mix (bag) concrete, if used for channel inverts and benches

C. Seal submittal drawings by Professional Engineer registered in State of Texas.

PART 2 P R O D U C T S

2.1 PRECAST CONCRETE MANHOLES

A. Provide manhole sections, base sections, and related components conforming to ASTM C 478. Provide base riser section with integral floors, unless shown otherwise. Provide adjustment rings which are standard components of manufacturer of manhole sections. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.

B. Construct barrels for precast manholes from standard reinforced concrete manhole sections of diameter indicated on Drawings. Use various lengths of manhole sections in combination to provide correct height with fewest joints. Design wall sections for depth and loading conditions in Paragraph 2.01 E, with minimum thickness of 5 inches. Base section shall have minimum thickness of 12 inches under invert.

C. Provide tops to support HS-20 vehicle loading, and receive cast iron frame covers, as indicated on Drawings.

D. Where manholes larger than 48-inch diameter are indicated on Drawings, provide precast base sections with flat slab top precast sections used to transition to 48-inch diameter manhole access riser sections. Transition can be concentric or eccentric unless otherwise shown on Drawings. Locate transition to provide minimum of 7-foot head clearance from base to underside of transition unless otherwise approved by Owner's Representative.

E. Design Loading Criteria: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed, by manufacturer, to requirements of ASTM C 478 for depth as shown on Drawings and to resist following loads.

1. AASHTO HS-20 vehicle loading applied to manhole cover and transmitted down to transition and base slabs
2. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections
3. Lateral soil pressure based on saturated soil conditions producing an at-rest equivalent fluid pressure of 100 pcf
4. Intemalliquid pressure based on unit weight of 63 pcf
5. Dead load of manhole sections fully supported by transition and base slabs

F. Design: Manhole walls, transition slabs, cone tops, and manhole base slab shall be designed according to requirements of ASTM C 478 and following:

1. Design additional reinforcing steel to transfer stresses at openings. Area of steel to be no less than shown on Drawings.
2. Wall loading conditions:
   a. Saturated soil pressure acting on empty manhole
   b. Manhole filled with liquid to a halfway depth as measured from invert to cover, with no balancing external soil pressure
3. Minimum clear distance between two wall penetrations shall be 12 inches or half diameter of smaller penetration, whichever is greater

G. Provide joints between sections with o-ring gaskets conforming to ASTM C 443.

H. When base is cast monolithic with portion of vertical section, extend reinforcing in vertical section into base.

I. Precast Concrete Base: Suitable cutouts or holes to receive pipe and connections. Lowest edge of holes or cutouts: For water line manhole, no less than 6 inches above inside surface of floor of base.

2.2 CONCRETE

A. Conform to requirements of Division 32.

B. Channel Inverts: Use 5 sack premix (bag) concrete or Class A concrete for inverts not integrally formed with manhole base, with minimum compressive strength of 4000 psi.

C. Cement Stabilized Sand Foundation: Provide cement stabilized sand foundation under base section in lieu of foundation slab, as shown on Drawings, conforming to requirements of Division 31.

D. Concrete Foundation: Provide Class A concrete with minimum compressive strength of 4000 psi for concrete foundation slab under manhole base section where indicated on Drawings.

2.3 REINFORCING STEEL

A. Conform to requirements of Division 32.

2.4 MORTAR

A. Conform to requirements of City of Houston Standard Specifications Section 04061 – Mortar.

2.5 MISCELLANEOUS METALS

A. Provide cast-iron frames, rings, and covers conforming to requirements of Division 33.

2.6 DROP CONNECTIONS AND STUBS

A. Provide drop connections and stubs conforming to same pipe material requirements used in main pipe, unless otherwise indicated on Drawings.

2.7 PIPE CONNECTIONS TO MANHOLE

A. Sanitary Sewers.

1. Provide resilient connectors conforming to requirements of ASTM C 923. Use the following materials for metallic mechanical devices as defined in ASTM C 923:
   a. External clamps: Type 304 stainless steel
   b. Internal, expandable clamps on standard manholes: Type 304 stainless steel, 11 gauge minimum.
   c. Internal, expandable clamps on corrosion-resistant manholes:
      1) Type 316 stainless steel, 11 gauge minimum
      2) Type 304 stainless steel, 11 gauge minimum, coated with minimum 16 mil fusion-bonded epoxy conforming to AWWA C 213
2. Where rigid joints between pipe and cast-in-place manhole base are specified or shown on Drawings, provide polyethylene-isoprene water-stop meeting physical property requirements of ASTM C 923, such as Press-Seal WS Series, or approved equal.

B. Storm Sewer Connections:

1. Provide watertight connections in accordance with ASTM C 923.

C. Water Lines

1. Where smooth exterior pipes, i.e., steel, ductile iron, or PVC pipes are connected to manhole base or barrel, seal space between pipe and manhole wall with assembly consisting of rubber gasket or links mechanically compressed to form a watertight

barrier. Assemblies: Press-Wedge, Res-Seal, Thunderline Link-Seal, or approved equal. See Drawings for placement of assembly in manhole sections.

2. When connecting concrete or cement mortar coated steel pipes, or as option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of a stainless steel power sleeve, stainless steel take-up clamp and a rubber gasket. Take-up clamp: Minimum of 9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

2.8 SEALANT MATERIALS

A. Provide sealing materials between precast concrete adjustment ring and manhole cover frame, Adeka Ultraseal P201, or approved equal.

B. Provide approved external sealing material from Canusa Wrapid Seal manhole encapsulation system, or approved equal.

C. Provide Butyl Sealant: Provide Press-Seal EZ Stick, or equal, for HDPE rings.

2.9 CORROSION RESISTANT MANHOLE MATERIALS

A. Where corrosion-resistant manholes or PVC-lined manholes are indicated on Drawings, provide one of following:

1. PVC liner for precast cylindrical manhole section, base sections, and cone sections in accordance with Division 33.
2. Precast base sections, as specified above, lined with PVC or equal and fiberglass manholes in accordance with Division 33.

2.10 BACKFILL MATERIALS

A. Conform to requirements of Division 31.

2.11 NON-SHRINK GROUT

A. Provide prepackaged, inorganic, flowable, non-gas-liberating, non-metallic, cement-based grout requiring only addition of water.

B. Meet requirements of ASTM C 1107 and have minimum 28-day compressive strength of 7000 psi.

2.12 VENT PIPES

A. Provide external vent pipes for manholes where indicated on Drawings.

B. Buried Vent Pipes: Provide 3 inch or 4 inch PVC DWV pipe conforming to ASTM D 2665. Alternatively, provide FRP pipe as specified for vent outlet assembly.

C. Vent Outlet Assembly: Provide vent outlet assembly as shown on Drawings, constructed of following specified materials:

1. FRP Pipe: Provide filament wound FRP conforming to ASTM D 2996 or centrifugally cast FRP conforming to ASTM D 2997. Seal cut ends in accordance with manufacturer's recommendations.

2. Joints and Fittings: Provide epoxy bodied fittings and join pipe to fittings with epoxy adhesive
3. Flanges: Provide socket-flange fittings for epoxy adhesive bonding to pipe ends where shown on Drawings. Meet bolt pattern and dimensions for ASME B 16.1, 125-pound flanges. Flange bolts shall be Type 304 stainless steel or hot-dip zinc coated, conforming to ASTM A 307, Class A or B.
4. Coating: Provide approved 2-component, aliphatic polyurethane coating using primer or tie coat recommended by manufacturer. Provide two or more coats to yield dry film thickness of at least 3 mils. Color shall be selected by The Engineer from manufacturer's standard colors.

2.13 PROHIBITED MATERIALS

A. Do not use brick masonry for construction of manholes, including adjustment of manholes to grade unless approved by the Engineer. Use only specified materials listed above.

2.14 MANHOLE LADDER FOR WATERLINE MANHOLES

A. Manhole Ladder: Fiberglass with 300-lb rating at appropriate length; conform to requirements of Occupational Safety and Health Standards (OSHA), U.S. Department of Labor except where shown on Drawings.

1. Use components, including rungs, made of fiberglass, fabricated with nylon or aluminum rivets and/or epoxy. Apply non-skid coating to ladder rungs. Mount ladder using manufacturer's recommended hardware.
2. Provide ladder as manufactured by Saf-Rail or approved equal. Locate ladder as shown on Drawings.
3. Fiberglass: Premium type polyester resin, reinforced with fiberglass; constructed to provide complete wetting of glass by resin; resistant to rot, fungi, bacterial growth and adverse effects of acids, alkalis and residential and industrial waste; yellow in color.
4. Provide approved petroleum-based tape encapsulating bolts in access manhole.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify that lines and grades are correct.

B. Determine if subgrade, when scarified and recompacted, can be compacted to 95 percent of maximum Standard Proctor Density according to ASTM D 698 prior to placement of foundation material and base section. When proper density is not reached, moisture condition subgrade until that density is reached or treat as unstable subgrade.

C. Do not build manholes in ditches, swales, or drainage paths unless approved by the Engineer.

3.2 PLACEMENT

A. Install precast manholes to conform to locations and dimensions shown on Drawings.

B. Place sanitary and storm manholes at points of change in alignment, grade, size, pipe intersections, and end of sewer unless otherwise shown on Drawings.

3.3 MANHOLE BASE SECTIONS AND FOUNDATIONS

A. Place precast base on 12 inch thick (minimum) foundation of crushed stone wrapped in filter fabric, cement stabilized sand, or concrete foundation slab. Compact cement-sand in accordance with requirements of Division 2.

B. Unstable Subgrade Treatment: When unstable subgrade is encountered, notify the Engineer for examination of subgrade to determine if subgrade has heaved upwards after being excavated. When heaving has not occurred, over-excavate subgrade to allow for 24 inch-thick layer of crushed stone wrapped in filter fabric as foundation material under manhole base. When there is evidence of heaving, provide pile-supported concrete foundation, as detailed on Drawings, under manhole base.

3.4 PRECAST MANHOLE SECTIONS

A. Install sections, joints, and gaskets in accordance with manufacturer's printed recommendations.

B. Install precast adjustment rings above tops of cones or flat-top sections as required to adjust finished elevation and to support manhole frame.

C. Seal any lifting holes with non-shrink grout.

D. Where PVC liners are required, seal joints between sections in accordance with manufacturer's recommendations.

E. Place at least two precast concrete grade rings with thickness of 12 inches or less, under casting.

3.5 PIPE CONNECTIONS AT MANHOLES

A. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer's instructions.

1. Where smooth exterior pipes, i.e. steel, ductile iron or PVC pipes are connected to manhole base or barrel, space between pipe and manhole wall shall be sealed with an assembly consisting of rubber gaskets or links mechanically compressed to form watertight barrier. Assemblies: "Press-Wedge," "Res-Seal," "Thunderline Link-Seals," or approved equal. See Drawings for placement of assembly in manhole sections.
2. When connecting concrete or cement mortar coated steel pipes, or as an option for connecting smooth exterior pipes to manhole base or barrel, space between pipe and manhole wall may be sealed with an assembly consisting of stainless steel power sleeve, stainless steel take-up clamp and rubber gasket. Take-up clamp: Minimum of9/16 inch wide. Provide PSX positive seal gasket system by Press-Seal Gasket Corporation or approved equal.

B. Grout storm sewer connections to manhole unless otherwise shown on Drawings. Grout pipe penetration in place on both inside and outside of manhole.

C. Ensure no concrete, cement stabilized sand, fill, or other rigid material is allowed to enter space between pipe and edge of wall opening at and around resilient connector on either interior or exterior of manhole. If necessary, fill space with compressible material to ensure full flexibility provided by resilient connector.

D. Where new manhole is constructed on existing sewer, rigid joint pipe may be used. Install waterstop gasket around existing pipe at center of cast-in-place wall. Join ends of split waterstop material at pipe springline using an adhesive recommended and supplied by waterstop manufacturer.

E. Test connection for watertight seal before backfilling.

3.6 INVERTS FOR SANITARY SEWERS

A. Construct invert channels to provide smooth flow transition waterway with no disruption of flow at pipe-manhole connections. Conform to following criteria:

1. Slope of invert bench: 1 inch per foot minimum; 1-1/ 2 inches per foot maximum
2. Depth of bench to invert:
   a. Pipes smaller than 15 inches: one-half of largest pipe diameter
   b. Pipes 15 to 24 inches: three-fourths of largest pipe diameter
   c. Pipes larger than 24 inches: equal to largest pipe diameter
3. Invert slope through manhole: 0.10 foot drop across manhole with smooth transition of invert through manhole, unless otherwise indicated on Drawings.

B. Form invert channels with concrete if not integral with manhole base section. For direction changes of mains, construct channels tangent to mains with maximum possible radius of curvature. Provide curves for side inlets and smooth invert fillets for flow transition between pipe inverts.

3.7 DROP CONNECTIONS FOR SANITARY SEWERS

A. Backfill drop assembly with crushed stone wrapped in filter fabric, cement stabilized sand, or Class A concrete to form solid mass. Extend cement stabilized sand or concrete encasement minimum of four (4) inches outside bells.

B. Install drop connection when sewer line enters manhole higher than 30 inches above invert of manhole.

3.8 STUBS FOR FUTURE CONNECTIONS

A. In manholes, where future connections are indicated on Drawings, install resilient connectors and pipe stubs with approved watertight plugs.

3.9 MANHOLE FRAME AND ADJUSTMENT RINGS

A. Combine precast concrete adjustment rings so elevation of installed casting cover matches pavement surface. Seal between concrete adjustment ring and precast top section with non-shrink grout; do not use mortar between adjustment rings. Apply latex-based bonding agent to precast concrete surfaces joined with non-shrink grout. Set cast iron frame on adjustment ring in bed of approved sealant material. Install sealant bed consisting of two beads of sealant, each bead having minimum dimensions of 1/2-inch and 1/2-inch wide.

B. Wrap manhole frame and adjustment rings with external sealing material, minimum 3 inches beyond joint between ring and frame and adjustment rings and precast section.

C. For manholes in unpaved areas, set top of frame minimum of 6 inches above existing ground line unless otherwise indicated on Drawings. In unpaved areas, encase manhole frame in mortar or non-shrink grout placed flush with face of manhole ring and top edge of frame. Provide rounded comer around perimeter.

3.10 BACKFILL

A. Place and compact backfill materials in area of excavation surrounding manholes in accordance with requirements of Division 31. Provide embedment zone backfill material, as specified for adjacent utilities, from manhole foundation up to an elevation 12 inches over each pipe connected to manhole. Provide trench zone backfill, as specified for adjacent utilities, above embedment zone backfill.

B. Where rigid joints are used for connecting existing sewers to manhole, backfill under existing sewer up to springline of pipe with Class B concrete or flowable fill.

C. In unpaved areas, provide positive drainage away from manhole frame to natural grade. Provide minimum of 4 inches of topsoil conforming to requirements of Division 32. When shown on Drawings, sod disturbed areas in accordance with Division 32.

3.11 FIELD QUALITY CONTROL

A. Conduct leakage testing of sanitary sewer manholes in accordance with requirements of Division 33.

3.12 PROTECTION

A. Protect manholes from damage until work has been accepted. Repair damage to manholes at no additional cost to the Owner.

END OF SECTION 33 05 13

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SECTION 33 05 16.13

PRECAST CONCRETE UTILITY STRUCTURES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Precast concrete inlets for storm or sanitary sewers, including cast iron frame and plate or grate.

B. Precast concrete headwalls and wingwalls for storm sewers.

C. Precast junction box with lid or grate top.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for inlets is on unit price basis for each inlet installed.
2. Payment for headwalls and wingwalls is on unit price basis for each headwall and wingwall installed.
3. Payment for junction box with lid or grate top is on unit price basis for each junction box installed.
4. Payment for inlets, headwalls, wingwalls, and junction boxes includes connection of lines and furnishing and installing frames, grates, rings, and covers.
5. Refer to Division 1 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 C 76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings for approval of design and construction details for precast concrete inlets, junction box headwalls, and wingwalls. Precast units differing from standard designs shown on Drawings will be rejected unless shop drawing submittals are approved. Clearly show proposed substitution is equal or superior in every aspect to standard designs.

C. Submit manufacturers' data and details for frames, grates, rings, and covers.

1.5 STORAGE AND SHIPMENT

A. Store precast units on level blocking. Do not place loads until design strength is reached. Shipment of acceptable units may be made when 28-day strength requirements have been met.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Concrete: Provide concrete for precast machine-made units meeting requirements of ASTM C 76 regarding reinforced concrete, cement, aggregate, mixture, and concrete test. Minimum 28-day compressive strength shall be 4,000 psi.

B. Reinforcing Steel: Place reinforcing steel to conform to details shown on Drawings and as follows:

1. Provide positive means for holding steel cages in place throughout production of concrete units. Maximum variation in reinforcement position is plus or minus 10 percent of wall thickness or plus or minus 1/2 inch, whichever is less. Regardless of variation, maintain minimum cover of concrete over reinforcement as shown on Drawings.
2. Welding of reinforcing steel is not permitted unless noted on Drawings.

C. Mortar and Hydraulic Cement: Conform to requirements of Division 32.

D. Miscellaneous Metal: Cast-iron frames and plates conforming to requirements of Division 33.

2.2 SOURCE QUALITY CONTROL

A. Tolerances: Allowable casting tolerances for concrete units are plus or minus 1/4 inch from dimensions shown on Drawings. Concrete thickness in excess of that required will not constitute cause for rejection provided that excess thickness does not interfere with proper jointing operations.

B. Precast Unit Identification: Mark date of manufacture and name or trademark of manufacturer clearly on inside of inlet, headwall, or wingwall.

C. Rejection: Precast units rejected for non-conformity with these specifications and for following reasons:

1. Fractures or cracks passing through shell, except for single end crack that does not exceed depth of joint.
2. Surface defects indicating honeycombed or open texture.
3. Damaged or misshaped ends, where damage would prevent making satisfactory joint.

D. Replacement: Immediately remove rejected units from Work site and replace with acceptable units.

E. Repairs: Occasional imperfections resulting from manufacture or accidental damage may be repaired if, in opinion of Owner’s Representative, repaired units conform to requirements of these specifications.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Verify lines and grades are correct.

B. Verify compacted subgrade will support loads imposed by inlets.

3.2 INSTALLATION

A. Install units complete in place to dimensions, lines, and grades as shown on Drawings.

B. Excavate in accordance with requirements of Division 31.

C. Bed precast concrete units on foundations of firm, stable material shaped to conform to shape of unit bases.

D. Provide adequate means to lift and place concrete units.

3.3 FINISHES

A. Use hydraulic cement to seal joints, fill lifting holes and as otherwise required.

B. When box section of inlet has been completed, shape floor of inlet with mortar to conform to Drawing details.

C. Adjust cast iron inlet plate frames to line, grade, and slope shown on Drawings. Grout frame in place with mortar.

3.4 INLET WATERTIGHTNESS

A. Verify that inlets are free of leaks. Repair leaks in approved manner.

3.5 CONNECTIONS

A. Connect storm sewer leads to inlets as shown on Drawings. Seal connections inside and outside with hydraulic cement. Make connections watertight.

3.6 BACKFILL

A. Backfill area of excavation surrounding each completed inlet, headwall, or wingwall according to requirements of Division 31.

END OF SECTION 33 05 16.13

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SECTION 33 05 16.16

CONCRETE FOR UTILITY CONSTRUCTION

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Cast-in-place concrete work for utility construction or rehabilitation, such as slabs on grade, small vaults, site-cast bases for precast units, and in-place liners for manhole rehabilitation.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No payment will be made for concrete for utility construction under this Section. Include cost in applicable utility structure.
2. Obtain services of and pay for certified testing laboratory to prepare design mixes.
3. Refer to Division 1 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. ACI 117 - Standard Tolerances for Concrete Construction and Materials.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.

C. ACI 302.1R - Guide for Concrete Floor and Slab Construction.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete.

E. ACI 308 - Standard Practice for Curing Concrete.

F. ACI 309R - Guide for Consolidation of Concrete.

G. ACI 311 - Guide for Concrete Plant Inspection and Field Testing of Ready-Mix Concrete.

H. ACI 315 - Details and Detailing of Concrete Reinforcement.

I. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.

J. ACI 544 - Guide for Specifying, Mixing, Placing, and Finishing Steel Fiber Reinforced Concrete.

K. ASTM A 82 - Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

L. ASTM A 185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

M. ASTM A 615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

N. ASTM A 767 - Standard Specifications for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

O. ASTM A 775 - Standard Specification for Epoxy-Coated Reinforcing Steel Bars.

P. ASTM A 820 - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete.

Q. ASTM A 884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

R. ASTM C 31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.

S. ASTM C 33 - Standard Specification for Concrete Aggregates.

T. ASTM C 39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

U. ASTM C 42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

V. ASTM C 94 - Standard Specification for Ready-Mixed Concrete.

W. ASTM C 138 - Standard Test Method for Unit Weight Yield and Air Content (Gravimetric) of Concrete.

X. ASTM C 143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

Y. ASTM C 150 - Standard Specification for Portland Cement.

Z. ASTM C 172 - Standard Practice for Sampling Freshly Mixed Concrete.

AA. ASTM C 173 - Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.

BB. ASTM C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

CC. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete.

DD. ASTM C 309 - Standard Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.

EE. ASTM C 494 - Standard Specification for Chemical Admixtures for Concrete.

FF. ASTM C 595 - Standard Specification for Blended Hydraulic Cements.

GG. ASTM C 685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.

HH. ASTM C 1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

II. ASTM C 1077 - Standard Practice for Laboratory Testing of Concrete and Concrete Aggregate for Use in Construction and Criteria for Laboratory Evaluation.

JJ. CRSI MSP-1 - Manual of Standard Practice.

KK. CRSI - Placing Reinforcing Bars.

LL. Federal Specification SS-S-210A - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

MM. NRMCA - Concrete Plant Standards.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed mix design and test data for each type and strength of concrete in Work.

C. Submit laboratory reports prepared by independent testing laboratory stating that materials used comply with requirements of this Section.

D. Submit manufacturer's mill certificates for reinforcing steel. Provide specimens for testing when required by Owner’s Representative.

E. Submit certification from concrete supplier that materials and equipment used to produce and deliver concrete comply with this Specification.

F. When required on Drawings, submit shop drawings showing reinforcement type, quantity, size, length, location, spacing, bending, splicing, support, fabrication details, and other pertinent information.

G. For waterstops, submit product information sufficient to indicate compliance with this Section, including manufacturer's descriptive literature and specifications.

1.5 HANDLING AND STORAGE

A. Cement: Store cement off of ground in well-ventilated, weatherproof building.

B. Aggregate: Prevent mixture of foreign materials with aggregate and preserve gradation of aggregate.

C. Reinforcing Steel: Store reinforcing steel to protect it from mechanical injury and formation of rust. Protect epoxy-coated steel from damage to coating.

PART 2 P R O D U C T S

2.1 CONCRETE MATERIALS

A. Cementitious Material:

1. Portland Cement: ASTM C 150, Type II, unless use of Type III is authorized by Owner’s Representative; or ASTM C 595, Type IP. For concrete in contact with sewage use Type II cement.
2. When aggregates are potentially reactive with alkalis in cement, use cement not exceeding 0.6 percent alkali content in form of Na2O + 0.658K20.

B. Water: Clean, free from harmful amounts of oils, acids, alkalis, or other deleterious substances, and meeting requirements of ASTM C 94.

C. Aggregate:

1. Coarse Aggregate: ASTM C 33. Unless otherwise indicated, use following ASTM standard sizes: No. 357 or No. 467; No. 57 or No. 67, No. 7. Maximum size: Not larger than 1/5 of narrowest dimension between sides of forms, nor larger than 3/4 of minimum clear spacing between reinforcing bars.
2. Fine Aggregate: ASTM C 33.
3. Determine potential reactivity of fine and coarse aggregate in accordance with Appendix to ASTM C 33.

D. Air Entraining Admixtures: ASTM C 260.

E. Chemical Admixtures:

1. Water Reducers: ASTM C 494, Type A.
2. Water Reducing Retarders: ASTM 494, Type D.
3. High Range Water Reducers (Superplasticizers): ASTM C 494, Types F and G.

F. Prohibited Admixtures: Admixtures containing calcium chloride, thiocyanate, or materials that contribute free chloride ions in excess of 0.1 percent by weight of cement.

G. Reinforcing Steel:

1. Use new billet steel bars conforming to ASTM A 615, ASTM A 767, or ASTM A 775, grade 60, as shown on Drawings. Use deformed bars except where smooth bars are specified. When placed in work, keep steel free of dirt, scale, loose or flaky rust, paint, oil or other harmful materials.
2. Where shown, use welded wire fabric with wire conforming to ASTM A 185 or ASTM A 884. Supply gauge and spacing shown, with longitudinal and transverse wires electrically welded together at points of intersection with welds strong enough not to be broken during handling or placing.
3. Wire: ASTM A 82. Use 16 1/2 gauge minimum for tie wire, unless otherwise indicated.

H. Fiber:

1. Fibrillated Polypropylene Fiber:
   a. Addition Rate: 1.5 pounds of fiber per cubic yard of concrete.
   b. Physical Properties:
      1) Material: Polypropylene
      2) Length: 1/2 inch or graded
      3) Specific Gravity: 0.9l
   c. Acceptable Manufacturer: W. R. Grace Company, Fibermesh, or approved equal.
2. Steel Fiber: Comply with applicable provisions of ACI 544 and ASTM A 820.
   a. Ratio: 50 to 200 pounds of fiber per cubic yard of concrete.
   b. Physical Properties:
      1) Material: Steel
      2) Aspect Ratio (for fiber lengths of 0.5 to 2.5 inch, length divided by diameter or equivalent diameter): 30:1 to 100:1
      3) Specific Gravity: 7.8
      4) Tensile Strength: 40-400 ksi.

5) Young's Modulus: 29,000 ksi
6) Minimum Average Tensile Strength: 50,000 psi
7) Bending Requirements: Withstand bending around 0.125-inch diameter mandrel to angle of 90 degrees, at temperatures not less than 60 degrees F, without breaking

I. Curing Compounds: Type 2 white-pigmented liquid membrane-forming compounds conforming to ASTM C 309.

2.2 FORM WORK MATERIALS

A. Lumber and Plywood: Seasoned and of good quality, free from loose or unsound knots, knot holes, twists, shakes, decay and other imperfections which would affect strength or impair finished surface of concrete. Use S4S lumber for facing or sheathing. Forms for bottoms of caps: At least 2 inch (nominal) lumber or 3/4 inch form plywood backed adequately to prevent misalignment. For general use, provide lumber of 1-inch nominal thickness or form plywood of approved thickness.

B. Form work for Exposed Concrete Indicated to Receive Rubbed Finish: Form or form-lining surfaces free of irregularities; plywood of 1/4 inch minimum thickness, preferably oiled at mill.

C. Chamfer Strips and Similar Moldings: Redwood, cypress, or pine that will not split when nailed and which can be maintained to true line. Use mill-cut molding dressed on all faces.

D. Form Ties: Metal or fiberglass of approved type with tie holes not larger than 7/8 inch in diameter. Do not use wire ties or snap ties.

E. Metal Forms: Clean and in good condition, free from dents and rust, grease, or other foreign materials that tend to disfigure or discolor concrete in gauge and condition capable of supporting concrete and construction loads without significant distortion. Countersink bolt and rivet heads on facing sides. Use only metal forms which present smooth surface and which line up properly.

2.3 PRODUCTION METHODS

A. Use either ready-mixed concrete conforming to requirements of ASTM C 94, or concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685.

2.4 MEASUREMENT OF MATERIALS

A. Measure dry materials by weight, except volumetric proportioning may be used when concrete is batched and mixed in accordance with ASTM C 685.

B. Measure water and liquid admixtures by volume.

2.5 DESIGN MIX

A. Use design mixes prepared by certified testing laboratory in accordance with ASTM C 1077 and conforming to requirements of this section.

B. Proportion concrete materials based on ACI 211.1 to comply with durability and strength requirements of ACI 318, Chapters 4 and 5, and this specification. Prepare mix design of Class A concrete so minimum cementitious content is 564 pounds per cubic yard. Submit concrete mix designs to Owner’s Representative for review.

C. Proportioning on basis of field experience or trial mixtures in accordance with requirements at Section 5.3 of ACI 318 may be used, when approved by Owner's Representative.

D. Classification:

Class	Type	Minimum Compressive Strength (LBS/Sq.In.)		Miximum W/C Ratio	Air Content (Percent)	Consistency Range in Slump (Inches)
		7-Day	28-Day	0.45		
A	Structural	3200	4000		4 ± 1	2 to 4*
B	Pipe Block Fill, Thrust Block	---	1500	---	4 ± 1	5 to 7
*When ASTM C 494, Types F or Type G admixture is used to increase workability, this range may be 6 to 9.						

E. Add steel or polypropylene fibers only when called for on Drawings or in another section of these Specifications.

F. Determine air content in accordance with ASTM C 138, ASTM C 173 or ASTM C 231.

G. Use of Concrete Classes: Use classes of concrete as indicated on Drawings and other Specifications. Use Class B for unreinforced concrete used for plugging pipes, seal slabs, thrust blocks, trench dams, tunnel inverts and concrete fill unless indicated otherwise. Use Class A for all other applications.

2.6 PVC WATERSTOPS

A. Extrude from virgin polyvinyl chloride elastomer. Use no reclaimed or scrap material. Submit waterstop manufacturer's current test reports and manufacturer's written certification that material furnished meets or exceeds Corps of Engineers Specification CRD-C572 and other specified requirements.

B. Flat Strip and Center-Bulb Waterstops:

1. Thickness: not less than 3/8 inch
2. Acceptable Manufacturers:
   a. Kirkhill Rubber Co., Brea, California
   b. Water Seals, Inc., Chicago, Illinois
   c. Progress Unlimited, Inc., New York, New York
   d. Greenstreak Plastic Products Co., St. Louis, Missouri
   e. Approved equal.

2.7 RESILIENT WATERSTOP

A. Resilient Waterstop: Where shown on Drawings; either bentonite- or adhesive-type material.

B. Bentonite Waterstop:

1. Material: 75 percent bentonite, mixed with butyl rubber-hydrocarbon containing less than 1.0 percent volatile matter, and free of asbestos fibers or asphaltics.
2. Manufacturer's rated temperature ranges: For application, 5 to 125 degrees F; in service, -40 to 212 degrees F.
3. Cross-sectional dimensions, unexpanded waterstop: 1 inch by 3/4 inch

4. Provide with adhesive backing capable of producing excellent adhesion to concrete surfaces.

C. Adhesive Waterstop:

1. Preformed plastic adhesive waterstop at least 2 inches in diameter.
2. Meets or exceeds requirements of Federal Specification SS-S-210A.
3. Supplied wrapped completely by 2 part protective paper.
4. Submit independent laboratory tests verifying that material seals joints in concrete against leakage when subjected to minimum of 30 psi water pressure for at least 72 hours.
5. Provide primer, to be used on hardened concrete surfaces, from same manufacturer who supplies waterstop material.
6. Acceptable Manufacturer: Synko-Flex Preformed Plastic Adhesive Waterstop, Synko-Flex Products, Inc.; or approved equal.

PART 3 E X E C U T I O N

3.1 FORMS AND SHORING

A. Provide mortar-tight forms sufficient in strength to prevent bulging between supports. Set and maintain forms to lines designated such that finished dimensions of structures are within tolerances specified in ACI 117. Construct forms to permit removal without damage to concrete. Forms may be given slight draft to permit ease of removal. Provide adequate clean out openings. Before placing concrete, remove extraneous matter from within forms.

B. Install rigid shoring having no excessive settlement or deformation. Use sound timber in shoring centering. Shim to adjust and tighten shoring with hardwood timber wedges.

C. Design Loads for Horizontal Surfaces of Forms and Shoring: Minimum fluid pressure, 175 pounds per cubic foot; live load, 50 pounds per square foot. Maximum unit stresses: 125 percent of allowable stresses used for form materials and for design of support structures.

D. Back form work with sufficient number of studs and wales to prevent deflection.

E. Re-oil or lacquer liner on job before using. Facing may be constructed of 3/4 inch plywood made with waterproof adhesive backed by adequate studs and wales. In such cases, form lining will not be required.

F. Unless otherwise indicated, form outside corners and edges with triangular 3/4 inch chamfer strips (measured on sides).

G. Remove metal form ties to depth of at least 3/4 inch from surface of concrete. Do not burn off ties. Do not use pipe spreaders. Remove spreaders which are separate from forms as concrete is being placed.

H. Treat facing of forms with approved form coating before concrete is placed. When directed by Owner’s Representative, treat both sides of face forms with coating. Apply coating before reinforcement is placed. Immediately before concrete is placed, wet surface of forms which will come in contact with concrete.

3.2 PLACING REINFORCEMENT

A. Place reinforcing steel accurately in accordance with approved Drawings. Secure steel adequately in position in forms to prevent misalignment. Maintain reinforcing steel in place using approved concrete and hot-dip galvanized metal chairs and spacers. Place reinforcing steel in accordance with CRSI Publication "Placing Reinforcing Bars." Request inspection of reinforcing steel by Owner's Representative and obtain acceptance before concrete is placed.

B. Minimum spacing center-to-center of parallel bars: 2 1/2 times nominal bar diameter. Minimum cover measured from surface of concrete to face of reinforcing bar unless shown otherwise on Drawings: 3 inches for surfaces cast against soil or subgrade, 2 inches for other surfaces.

C. Detail bars in accordance with ACI 315. Fabricate reinforcing steel in accordance with CRSI Publication MSP-1, "Manual of Standard Practice." Bend reinforcing steel to required shape while steel is cold. Excessive irregularities in bending will be cause for rejection.

D. Do not splice bars without written approval of Owner's Representative. Approved bar bending schedules or placing drawings constitute written approval. Splice and development length of bars shall conform to ACI 318, Chapters 7 and 12, and as shown on Drawings. Stagger splices or locate at points of low tensile stress.

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3.3 EMBEDDED ITEMS

A. Install conduit and piping as shown on Drawings. Accurately locate and securely fasten conduit, piping, and other embedded items in forms.

B. Install waterstops as specified in other sections and according to manufacturer's instructions. Securely position waterstops at joints as indicated on Drawings. Protect waterstops from damage or displacement during concrete placing operations.

3.4 BATCHING, MIXING AND DELIVERY OF CONCRETE

A. Measure, batch, mix, and deliver ready-mixed concrete in accordance with ASTM C 94, Sections 8 through 11. Produce ready-mixed concrete using automatic batching system as described in NRMCA Concrete Plant Standards, Part 2 - Plant Control Systems.

B. Measure, mix and deliver concrete produced by volumetric batching and continuous mixing in accordance with ASTM C 685, Sections 6 though 8.

C. Maintain concrete workability without segregation of material and excessive bleeding. Obtain approval of Owner's Representative before adjustment and change of mix proportions.

D. Ready-mixed concrete delivered to site shall be accompanied by batch tickets providing information required by ASTM C 94, Section 16. Concrete produced by continuous mixing shall be accompanied by batch tickets providing information required by ASTM C 685, Section 14.

E. When adverse weather conditions affect quality of concrete, postpone concrete placement. Do not mix concrete when air temperature is at or below 40 degrees F and falling. Concrete may be mixed when temperature is 35 degrees F and rising. Take temperature readings in shade, away from artificial heat. Protect concrete from temperatures below 32 degrees F until concrete has cured for minimum of 3 days at 70 degrees F or 5 days at 50 degrees F.

F. Clean, maintain and operate equipment so that it thoroughly mixes material as required.

G. Hand-mix only when approved by Owner's Representative.

3.5 PLACING CONCRETE

A. Give sufficient advance notice to Owner's Representative (at least 24 hours prior to commencement of operations) to permit inspection of forms, reinforcing steel, embedded items and other preparations for placing concrete. Place no concrete prior to Owner's Representative's approval.

B. Schedule concrete placing to permit completion of finishing operations in daylight hours. However, when necessary to continue after daylight hours, light site as required. When rainfall occurs after placing operations are started, provide covering to protect work.

C. Use troughs, pipes and chutes lined with approved metal or synthetic material in placing concrete so that concrete ingredients are not separated. Keep chutes, troughs and pipes clean and free from coatings of hardened concrete. Allow no aluminum material to be in contact with concrete.

D. Limit free fall of concrete to 4 feet. Do not deposit large quantities of concrete at one location so that running or working concrete along forms is required. Do not jar forms after concrete has taken initial set; do not place strain on projecting reinforcement or anchor bolts.

E. Use tremies for placing concrete in walls and similar narrow or restricted locations. Use tremies made in sections, or provide in several lengths, so that outlet may be adjusted to proper height during placing operations.

F. Place concrete in continuous horizontal layers approximately 12 inches thick. Place each layer while layer below is still plastic.

G. Compact each layer of concrete with concrete spading implements and mechanical vibrators of approved type and adequate number for size of placement. When immersion vibrators cannot be used, use form vibrators. Apply vibrators to concrete immediately after depositing. Move vibrator vertically through layer of concrete just placed and several inches into plastic layer below. Do not penetrate or disturb layers previously placed which have partially set. Do not use vibrators to aid lateral flow concrete. Closely supervise consolidation to ensure uniform insertion and duration of immersion.

H. Handling and Placing Concrete: Conform to ACI 302.1R, ACI 304R and ACI 309R.

3.6 WATERSTOPS

A. Embed waterstops in concrete across joints as shown. Waterstops shall be continuous for extent of joint; make splices necessary to provide continuity in accordance with manufacturer's instructions. Support and protect waterstops during construction operations; repair or replace waterstops damaged during construction.

B. Install waterstops in concrete on one side of joints, leaving other side exposed until next pour. When waterstop will remain exposed for 2 days or more, shade and protect exposed waterstop from direct rays of sun during entire exposure and until exposed portion of waterstop is embedded in concrete.

C. Splicing PVC Waterstops:

1. Splice waterstops by heat-sealing adjacent waterstop sections in accordance with manufacturer's printed instructions.
2. Butt end-to-end joints of two identical waterstop sections may be made in forms during placement of waterstop material.
3. Prior to placement in form work, prefabricate waterstop joints involving more than two ends to be joined together, angle cut, alignment change, or joining of two dissimilar waterstop sections, allowing not less than 24 inch long strips of waterstop material beyond joint. Upon inspection and approval by Owner's Representative, install prefabricated waterstop joint assemblies in form work, and butt-weld ends of 24 inch strips to straight-run portions of waterstop in forms.

D. Setting PVC Waterstops:

1. Correctly position waterstops during installation. Support and anchor waterstops during progress of work to ensure proper embedment in concrete and to prevent folding over of waterstop by concrete placement. Locate symmetrical halves of waterstops equally between concrete pours at joints, with center axis coincident with joint openings. Thoroughly work concrete in joint vicinity for maximum density and imperviousness.
2. Where waterstop in a vertical wall joint does not connect with any other waterstop, and is not intended to be connected to waterstop in future concrete placement, terminate waterstop 6 inches below top of wall.

E. Replacement of Defective Field Joints: Replace waterstop field joints showing evidence of misalignment, offset, porosity, cracks, bubbles, inadequate bond or other defects with products and joints complying with Specifications.

F. Resilient Waterstop:

1. Install resilient waterstop in accordance with manufacturer's instructions and recommendations.
2. When requested by Owner's Representative, provide technical assistance by manufacturer's representative in field at no additional cost to City.
3. Use resilient waterstop only where complete confinement by concrete is provided; do not use in expansion or contraction joints.
4. Where resilient waterstop is used in combination with PVC waterstop, lap resilient waterstop over PVC waterstop minimum of 6 inches and place in contact with PVC waterstop. Where crossing PVC at right angles, melt PVC ribs to form smooth joining surface.
5. At free top of walls without connecting slabs, stop resilient waterstop and grooves (where used) 6 inches from top in vertical wall joints.
6. Bentonite Waterstop:
   a. Locate bentonite waterstop as near as possible to center of joint and extend continuous around entire joint. Minimum distance from edge of waterstop to face of member: 5 inches.
   b. Where thickness of concrete member to be placed on bentonite waterstop is less than 12 inches, place waterstop in grooves at least 3/4 inch deep and 1 1/4 inches wide formed or ground into concrete. Minimum distance from edge of waterstop placed in groove to face of member: 2.5 inches.
   c. Do not place bentonite waterstop when waterstop material temperature is below 40 degrees F. Waterstop material may be warmed so that it remains above 40 degrees F during placement but means used to warm it shall in no

way harm material or its properties. Do not install waterstop where air temperature falls outside manufacturer's recommended range.

d. Place bentonite waterstop only on smooth and uniform surfaces; grind concrete smooth when necessary to produce satisfactory substrate, or bond waterstop to irregular surfaces using epoxy grout which completely fills voids and irregularities beneath waterstop material. Prior to installation, wire brush concrete surface to remove laitance and other substances that may interfere with bonding of epoxy.

e. In addition to adhesive backing provided with waterstop, secure bentonite waterstop in place with concrete nails and washers at 12 inch maximum spacing.

7. Adhesive Waterstop:

a. With wire brush thoroughly clean concrete surface on which waterstop is to be placed and then coat with primer.

b. If surface is too rough to allow waterstop to form complete contact, grind to form adequately smooth surface.

c. Install waterstop with top protective paper left in place. Overlap joints between strips minimum of 1 inch and cover back over with protective paper.

d. Do not remove protective paper until just before final form work completion. Place concrete immediately. time that waterstop material is uncovered prior to concrete placement shall be minimized and shall not exceed 24 hours.

3.7 CONSTRUCTION JOINTS

A. Definitions:

1. Construction joint: Contact surface between plastic (fresh) concrete and concrete that has attained initial set.
2. Monolithic: Manner of concrete placement to reduce or eliminate construction joints; joints other than those indicated on Drawings will not be permitted without written approval of Owner’s Representative. Where so approved, make additional construction joints with details equivalent to those indicated for joints in similar locations.
3. Preparation for Construction Joints: Roughen surface of concrete previously placed, leaving some aggregate particles exposed. Remove laitance and loose materials by sandblasting or high-pressure water blasting. Keep surface wet for several hours prior to placing of plastic concrete.

3.8 CURING

A. Comply with ACI 308. Cure by preventing loss of moisture, rapid temperature change and mechanical injury for period of 7 curing days when Type II or IP cement has been used and for 3 curing days when Type III cement has been used. Start curing as soon as free water has disappeared from concrete surface after placing and finishing. A curing day is any calendar day in which temperature is above 50 degrees F for at least 19 hours. Colder days may be counted when air temperature adjacent to concrete is maintained above 50 degrees F. In continued cold weather, when artificial heat is not provided, removal of forms and shoring may be permitted at end of calendar days equal to twice required number of curing days. However, leave soffit forms and shores in place until concrete has reached specified 28 day strength, unless directed otherwise by Owner’s Representative.

B. Cure formed surfaces not requiring rubbed-finished surface by leaving forms in place for full curing period. Keep wood forms wet during curing period. Add water as needed for other types of forms. Or, at Contractor's option, forms may be removed after 2 days and curing compound applied.

C. Rubbed Finish:

1. At formed surfaces requiring rubbed finish, remove forms as soon as practicable without damaging surface.
2. After rubbed-finish operations are complete, continue curing formed surfaces by using either approved curing/sealing compounds or moist cotton mats until normal curing period is complete.

D. Unformed Surfaces: Cure by membrane curing compound method.

1. After concrete has received final finish and surplus water sheen has disappeared, immediately seal surface with uniform coating of approved curing compound, applied at rate of coverage recommended by manufacturer or as directed by Owner's Representative. Do not apply less than 1 gallon per 180 square feet of area. Provide satisfactory means to properly control and check rate of application of compound.
2. Thoroughly agitate compound during use and apply by means of approved mechanical power pressure sprayers equipped with atomizing nozzles. For application on small miscellaneous items, hand-powered spray equipment may be used. Prevent loss of compound between nozzle and concrete surface during spraying operations.
3. Do not apply compound to dry surface. When concrete surface has become dry, thoroughly moisten surface immediately prior to application. At locations where coating shows discontinuities, pinholes or other defects, or when rain falls on newly coated surface before film has dried sufficiently to resist damage, apply additional coat of compound at specified rate of coverage.

3.9 REMOVAL OF FORMS AND SHORING

A. Remove forms from surfaces requiring rubbing only as rapidly as rubbing operation progresses. Remove forms from vertical surfaces not requiring rubbed-finish when concrete has aged for required number of curing days. When curing compound is used, do not remove forms before 2 days after concrete placement.

B. Leave soffit forms and shores in place until concrete has reached specified 28-day strength, unless directed otherwise by Owner's Representative.

3.10 DEFECTIVE WORK

A. Immediately repair defective work discovered after forms have been removed. When concrete surface is bulged, uneven, or shows excess honeycombing or form marks which cannot be repaired satisfactorily through patching, remove and replace entire section.

3.11 FINISHING

A. Patch honeycomb, minor defects and form tie holes in concrete surfaces with cement mortar mixed one part cement to two parts fine aggregate. Repair defects by cutting out unsatisfactory material and replacing with new concrete, securely keyed and bonded to existing concrete. Finish to make junctures between patches and existing concrete as inconspicuous as possible. Use stiff mixture and thoroughly tamp into place. After each patch has stiffened sufficiently to allow for greatest portion of shrinkage, strike off mortar flush with surface.

B. Apply rubbed finish to exposed surfaces of formed concrete structures as noted on Drawings. After pointing has set sufficiently, wet surface with brush and perform first surface rubbing with No. 16 carborundum stone, or approved equal. Rub sufficiently to bring surface

to paste, to remove form marks and projections, and to produce smooth, dense surface. Add cement to form surface paste as necessary. Spread or brush material, which has been ground to paste, uniformly over surface and allow to reset. In preparation for final acceptance, clean surfaces and perform final finish rubbing with No. 30 carborundum stone or approved equal. After rubbing, allow paste on surface to reset; then wash surface with clean water. Leave structure with clean, neat and uniform-appearing finish.

C. Apply wood float finish to concrete slabs.

3.12 FIELD QUALITY CONTROL

A. Testing shall be performed under provisions of Division 1.

B. Unless otherwise directed by Owner's Representative, following minimum testing of concrete is required. Testing shall be performed by qualified individuals employed by approved independent testing agency, and conform to requirements of ASTM C 1077.

1. Take concrete samples in accordance with ASTM C 172.
2. Make one set of four compression test specimens for each mix design at least once per day and for each 150 cubic yards or fraction thereof. Make, cure and test specimens in accordance with ASTM C 31 and ASTM C 39.
3. When taking compression test specimens, test each sample for slump according to ASTM C 143, for temperature according to ASTM C 1064, for air content according to ASTM C 231, and for unit weight according to ASTM C 138.
4. Inspect, sample and test concrete in accordance with ASTM C 94, Section 13, 14, and 15, and ACI 311-5R.

C. Test Cores: Conform to ASTM C 42.

D. Testing High Early Strength Concrete: When Type III cement is used in concrete, specified 7 day and 28 day compressive strengths shall be applicable at 3 and 7 days, respectively.

E. If 7-day or 3-day test strengths (as applicable for type of cement being used) fail to meet established strength requirements, extended curing or resumed curing on those portions of structure represented by test specimens may be required. When additional curing fails to produce required strength, strengthening or replacement of portions of structure which fail to develop required strength may be required by Owner's Representative, at no additional cost to City.

3.13 PROTECTION

A. Protect concrete against damage until final acceptance by City.

B. Protect fresh concrete from damage due to rain, hail, sleet, or snow. Provide protection while concrete is still plastic, and whenever precipitation is imminent or occurring.

C. Do not backfill around concrete structures or subject them to design loadings until components of structure needed to resist loading are complete and have reached specified 28 day compressive strength, except as authorized otherwise by Owner's Representative.

END OF SECTION 33 05 16.16

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SECTION 33 06 10.14

POLYVINYL CHLORIDE (PVC) PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Polyvinyl chloride pressure pipe for water distribution, in nominal diameters 4 inches through 20 inches.

B. Polyvinyl chloride sewer pipe for gravity sewers in nominal diameters 4 inches through 48 inches.

C. Polyvinyl chloride pressure pipe for gravity sewers and force mains in nominal diameters 4 inches through 20 inches.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for PVC pipe under this Section. Include cost in unit price for work included as specified Division 2.
2. Refer to Division 1 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. ANSI A 21.16 (AWWA C 116) - Protective Fusion Bonded Epoxy Coating for the Interior and Exterior Surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.

B. ASTM D 1248 - Standard Specification for Polyethylene Plastics Molding and Extrusion Materials.

C. ASTM D 1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

D. ASTM D 2241 - Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

E. ASTM D 2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

F. ASTM D 2444 - Standard Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight).

G. ASTM D 2680 - Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.

H. ASTM D 3034 - Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

I. ASTM D 3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

L. ASTM F 679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

M. ASTM F 794 - Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

N. ASTM F 949 - Standard Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with Smooth Interior and Fittings.

O. AWWA C 110 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches for Water.

P. AWWA C 111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

Q. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches for Water Distribution.

R. AWWA C 905 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution.

S. AWWA C 909 - Standard for Molecularly-Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 Inches through 12 Inches (100mm through 300 mm), for Water Distribution.

T. PPI TR3 - Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Materials.

U. UNI-B-13 - Recommended Standard Performance Specification for Joint Restraint Devices for Use with Polyvinyl Chloride Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings showing design of new pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fittings, flanges, and special details.

1.5 QUALITY CONTROL

A. Submit manufacturer's certifications that PVC pipe and fittings meet requirements of this Section and AWWA C 900, AWWA C 909 and AWWA C 905 for pressure pipe applications, or appropriate ASTM standard specified for gravity sewer pipe.

B. Submit manufacturer's certification that PVC pressure pipe for water lines and force mains has been hydrostatically tested at factory in accordance with AWWA C 900, AWWA C 909 and AWWA C 905, and this Section.

C. When foreign manufactured material is proposed for use, have material tested for conformance to applicable ASTM requirements by certified independent testing laboratory

located in United States. Certification from other source is not acceptable. Furnish copies of test reports to Owner's Representative for review. Cost of testing paid by Contractor.

PART 2 P R O D U C T S

2.1 MATERIAL

A. Use PVC compounds in manufacture of pipe that contain no ingredient in amount that has been demonstrated to migrate into water in quantities considered to be toxic.

B. Furnish PVC pressure pipe manufactured from Class 12454-A or Class 12454-B virgin PVC compounds as defined in ASTM D 1784. Use compounds qualifying for rating of 4000 psi for water at 73.4 F per requirements of PPI TR3. Provide pipe which is homogeneous throughout, free of voids, cracks, inclusions, and other defects, uniform as commercially practical in color, density, and other physical properties. Deliver pipe with surfaces free from nicks and scratches with joining surfaces of spigots and joints free from gouges and imperfections which could cause leakage.

C. PVC Restrained Pipe: Must be listed on City's current Product Approval List.

1. Pipe Material:
   a. DR 18: For restrained joints where shown on Drawings.
   b. DR 14: For alternate to offset pipe sections shown on Drawings. Do not use PVC for offset sections with depth of cover greater than 20 feet or less than 4 feet. Do not use PVC in potentially petroleum contaminated areas.

D. Water Service.

1. Provide self-extinguishing PVC pipe that bears Underwriters' Laboratories mark of approval and is acceptable without penalty to Texas State Fire Insurance Committee for use in fire protection lines.
2. Bear National Sanitation Foundation Seal of Approval (NSF-PW).

E. Gaskets:

1. Gaskets shall meet requirements of ASTM F 477. Use elastomeric factory-installed gaskets to make joints flexible and watertight.
2. Flat Face Mating Flange: Full faces 1/8-inch-thick ethylene propylene (EPR) rubber.
3. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EDR) rubber, with filler gasket between OD of raised face and flange OD to protect flange from bolting moment.

F. Lubricant for rubber-gasketed joints: Water soluble, non-toxic, non-objectionable in taste and odor imparted to fluid, non-supporting of bacteria growth, having no deteriorating effect on PVC or rubber gaskets.

G. Do not use PVC in potentially or known contaminated areas.

H. Do not use PVC in areas exposed to direct sunlight.

2.2 WATER SERVICE PIPE

A. Pipe 4 inch through 12 inch: AWWA C 900, AWWA C 909, Class 150, DR 18; AWWA C 900, Class 200, DR 14 as alternate to offset pipe sections; nominal 20-foot lengths; cast-iron equivalent outside diameters.

B. Pipe 14 inch through 20 inch: AWWA C 905; Class 235; DR 18; nominal 20-foot lengths; cast-iron equivalent outside diameter.

C. Provide Polyvinyl Chloride Pipe from approved manufacturers.

D. Make curves and bends by deflecting joints. Do not exceed maximum deflection recommended by pipe manufacturer. Submit details of other methods of providing curves and bends for review by Owner's Representative.

E. Hydrostatic Test: AWWA C 900, AWWA C 905, AWWA C 909, ANSI A 21.10 (AWWA C 110); at point of manufacture; submit manufacturer's written certification.

2.3 GRAVITY SEWER PIPE

A. PVC gravity sanitary sewer pipe and storm sewer pipe shall be in accordance with provisions in following table:

Wall Construction	Manufacturer	ASTM Designation	SDR (Max.)/ Stiffness (Min.)	Diameter Size Range
Solid	J-M Pipe Certain Teed Diamond Uponor ETI North American	D3034	SDR 26 / PS 115	6" to 10"
		D3034	SDR 35 / PS 46	12" & 15"
		F679	SDR 35 / PS 46	18" to 27"
		AWWA C900	DR 18 / N/A	4" to 12"
		AWWA C909	DR 18 / N/A	4" to 12"
		AWWAC905	DR 18 / N/A	14" to 16"
Truss (Gasketed)	Contech	D2680	N/A / 200 psi	8" to 15"
Profile	Contech A-2000 Contech A-2026 ETI, Ultra-Rib ETI, Ultra-Corr	F949 F949 F794 F794	N/A / 46 psi N/A / 115 psi N/A / 46 psi N/A / 46 psi	12" to 36" 8" to 10" 8" to 30" 24" to 36"

B. When solid wall PVC pipe 18 inches to 27 inches in diameter is required in SDR 26, provide pipe conforming to ASTM F 679, except provide wall thickness as required for SDR 26 and pipe strength of 115 psi.

C. For sewers up to 12-inch diameter crossing over water lines, or crossing under water lines with less than 2-feet separation, provide minimum 150 psi pressure-rated pipe conforming to ASTM D 2241 with suitable PVC adapter couplings.

D. Joints: Spigot and integral wall section bell with solid cross section elastomeric or rubber ring gasket conforming to requirements of ASTM D 3212 and ASTM F 477, or ASTM D 3139 and ASTM F 477. Gaskets shall be factory-assembled and securely bonded in place to prevent displacement. Manufacturer shall test sample from each batch conforming to requirements ASTM D 2444.

E. Fittings: Provide PVC gravity sewer sanitary bends, tee, or wye fittings for new sanitary sewer construction. PVC pipe fittings shall be full-bodied, either injection molded or factory fabricated. Saddle-type tee or wye fittings are not acceptable.

F. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner's Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F

and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

G. Pipe Stiffness. Determine pipe stiffness at 5 percent deflection in accordance with Test Method D 2412. Minimum pipe stiffness shall be 46 psi. For diameters 4 inches through 18 inches, test three specimens, each a minimum of 6 inches (152 mm) in length. For diameters 21 inch through 36 inch, test three specimens, each a minimum of 12 inch (305 mm) in length.

H. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.04F, in suitable press until internal diameter has been reduced to 60 percent of original inside diameter of pipe. Rate of loading shall be uniform. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles. Perform the flattening test in conjunction with pipe stiffness test.

I. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except that joint shall remain watertight at minimum deflection of 5 percent. Manufacturer will be required to provide independent third party certification for joint testing each diameter of storm sewer pipe.

J. Purpose of Tests. Flattening and pipe stiffness tests are intended to be routine quality control tests. Joint tightness test is intended to qualify pipe to specified level of performance.

2.4 SANITARY SEWER FORCE MAIN PIPE

A. Provide approved PVC pressure pipe conforming to requirements for water service pipe, and conforming to minimum working pressure rating specified in Division 33.

B. Acceptable pipe joints are integral bell-and-spigot, containing a bonded-in elastomeric sealing ring meeting requirements of ASTM F 477. In designated areas requiring restrained joint pipe and fittings, use approved joint restraint device conforming to UNI-B-13, for PVC pipe 12-inch diameter and less.

C. Fittings: Provide approved ductile iron fittings as per Division 33, except furnish fittings with one of following approved internal linings:

1. Nominal 40 mils (35 mils minimum) virgin polyethylene complying with ASTM D 1248, heat fused to interior surface of fitting
2. Nominal 40 mils (35 mils minimum) polyurethane
3. Nominal 40 mils (35 mils minimum) ceramic epoxy
4. Nominal 40 mils (35 mils minimum) fusion bonded epoxy

D. Exterior Protection: Provide polyethylene wrapping of ductile-iron fittings as required by Division 33.

E. Hydrostatic Tests: Hydrostatically test pressure rated pipe in accordance with Paragraph 2.02E.

2.5 BENDS AND FITTINGS FOR PVC PRESSURE PIPE

A. Bends and Fittings: ANSI A 21.10 or ANSI A 21.53, ductile iron; ANSI A 21.11 single rubber gasket push-on type joint; minimum 150 psi pressure rating. Approved restrained joints, 250 200 psi, may be provided for up to 12 inches in diameter (water or sanitary).

B. Provide approved restrained joint fittings: Integral restrained joint fittings and pipe do not require secondary restraint.

PART 3 E X E C U T I O N

3.1 PROTECTION

A. Store pipe under cover out of direct sunlight and protect from excessive heat or harmful chemicals in accordance with manufacturer’s recommendations.

3.2 INSTALLATION

A. Conform to requirements of Division 33, as applicable.

B. Install PVC pipe in accordance with Division 33, ASTM D 2321 for Sewer Pipe, and manufacturer's recommendations.

C. Install PVC water service pipe to clear utility lines and have minimum depth of cover below property line grade of street, unless otherwise required by Drawings:

1. Water service pipe 12 inches in diameter and smaller 4 feet of cover.
2. Water service pipe 16 inches in diameter and larger 5 feet of cover.

D. Avoid imposing strains that will overstress or buckle pipe when lowering pipe into trench.

E. Hand shovel pipe bedding under pipe haunches and along sides of pipe barrel and compact to eliminate voids and ensure side support.

F. Store PVC pipe under cover out of direct sunlight. Protect pipe from excessive heat or harmful chemicals. Prevent damage by crushing or piercing.

G. Allow PVC pipe to cool to ground temperature before backfilling when assembled out of trench to prevent pullout due to thermal contraction.

3.3 PVC RESTRAINED MECHANISM

A. Do not apply lubricant to spline or pipe or coupling spline grooves.

B. Do not use excessive force while inserting the spline through coupling.

C. Insert spline until it is fully seated around circumference of pipe.

D. Field Cutting of Pipe Ends:

1. Perform by workers certified by manufacturer.
2. Use a PVC pipe cutter and provide square ends.
3. Use manufacturer approved power routing and grooving tool to field fabricate required pipe groove.

END OF SECTION 33 06 10.14

SECTION 33 06 10.15
DUCTILE IRON PIPE AND FITTINGS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Ductile iron pipe and fittings for water mains, wastewater force mains, gravity sanitary sewers, and storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for ductile iron pipe and fittings under this Section, with the exception of extra fittings in place. Include cost in unit prices for work as specified in the following Sections, as applicable:

   a. 33 11 00 - Water Utility Distribution Piping.
   b. 33 31 00 – Sanitary Utility Sewerage Piping.
   c. 33 41 00 - Storm Utility Drainage Piping.

B. 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.

1.03 REFERENCES

A. ANSI A 21.4 (AWWA C 104) - Cement-Mortar Lining for Ductile-Iron and Gray-Iron Pipe and Fittings, for Water and Other Liquids.

B. ANSI A 21.10 (AWWA C 110) - Ductile-Iron and Gray-Iron Fittings, 3-in. through 48-in., for Water and Other Liquids.

C. ANSI A 21.11 (AWWA C 111) - Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.

D. ANSI A 21.15 (AWWA C 115) - Flanged Ductile-Iron Pipe with Threaded Flanges.

E. ANSI A 21.50 (AWWA C 150) - Thickness Design of Ductile-Iron Pipe.

F. ANSI A 21.51 (AWWA C 151) - Ductile-Iron Pipe, Centrifugally Cast for Water and Other Liquids.

G. ANSI A 21.53 (AWWA C 153) - Ductile Iron Compact Fittings, 3 inches through 24 inches and 54 inches through 64 inches for water service.

H. ANSI B 16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

I. ASTM D 1248 - Polyethylene Plastics Molding and Extrusion Materials.

J. ASTM G 62 - Test Methods for Holiday Detection in Pipeline Coatings.

K. AWWA C 600 - Standard for Installation of Ductile Iron Water Mains and Their Appurtenances.

L. SSPC-SP 6 - Steel Structures Painting Council, Commercial Blast Cleaning.

1.04 SUBMITTALS

A. Conform to requirements of Section - Submittal Procedures.

B. Submit shop drawings showing design of pipe and fittings indicating alignment and grade, laying dimensions, fabrication, fitting, flange, and special details. Show station numbers for pipe and fittings corresponding to Drawings. Production of pipe and fittings prior to review by Engineer is at Contractor's risk.

1.05 QUALITY CONTROL

A. Provide manufacturer's certifications that all ductile iron pipe and fittings meet provisions of this Section and have been hydrostatically tested at factory and meet requirements of ANSI A 21.51.

B. Provide certifications that all pipe joints have been tested and meet requirements of ANSI A 21.11.

PART 2 P R O D U C T S

2.01 DUCTILE IRON PIPE

A. Ductile Iron Pipe Barrels: ANSI A 21.15, ANSI A 21.50 or ANSI A 21.51; bear mark of Underwriters' Laboratories approval; minimum thickness Class 51 for water mains and Class 52 for sanitary sewers, or as shown on Drawings. Provide minimum thickness Class 53 for flanged pipe.

B. Provide pipe sections in standard lengths, not less than 18 feet long, except for special fittings and closure sections as indicated on shop drawings.

2.02 JOINTS

A. Joint Types: ANSI A 21.11 push-on; ANSI A 21.11 mechanical joint; or ANSI A 21.15 flanged end. Provide push-on joints unless otherwise indicated on the Drawings or required by these specifications. For bolted joints, bolts shall conform to requirements of AWWA C 111.

B. Where restrained joints for buried service are required by Drawings, provide one of the following, or equal:

1. Super-Lock Joint by Clow Corporation.
2. Flex-Ring or Lok-Ring by American Cast Iron Pipe Company.
3. TR-Flex Joint by U.S. Pipe and Foundry Company.

C. Threaded- or grooved-type joints which reduce pipe wall thickness below minimum required are not acceptable.

D. Provide for restrained joints designed to meet test pressures required under Section 33 13 00.10 - Hydrostatic Testing of Pipelines as applicable.

E. Where ductile iron water main is cathodically protected from corrosion, bond rubber gasketed joints as shown on Drawings to provide electrical continuity along entire pipeline, except where insulating flanges are required by Drawings.

2.03 GASKETS

A. Furnish, when no contaminant is identified, plain rubber (SBR) gasket material; for flanged joints 1/8-inch-thick gasket in accordance with ANSI A 21.15.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed pipeline, shall have the following gasket materials for the noted contaminants:

Contaminant	Gasket Material Required
Petroleum (diesel, gasoline)	Nitrile Rubber
Other contaminants	As recommended by the pipe manufacture

2.04 FITTINGS

A. Use fittings of same size as pipe. Reducers are not permitted to facilitate an off-size fitting. Reducing bushings are also prohibited. Make reductions in piping size by reducing fittings. Line and coat fittings as specified for pipe they serve.

B. Push-on Fittings: ANSI A 21.10; ductile iron ANSI A 21.11 joints, gaskets, and lubricants; pressure rated at 250 psig.

C. Flanged Fittings: ANSI A 21.10; ANSI B 16.1 cast or ductile iron. Flanges: ANSI B 16.1, Class 125; pressure rated at 250 psig.

D. Mechanical Joint Fittings: ANSI A 21.11 (AWWA C 110); pressure rated at 250 psi.

E. Ductile Iron Compact Fittings for Water Mains: ANSI A 21.53; 4-inch through 12-inch diameter; cement-mortar lining; conform to requirements Division 33 - Polyethylene Wrap.

2.05 COATINGS AND LININGS

A. Water Main Interiors: ANSI A21.4, cement lined with seal coat.

B. Sanitary Sewer and Force Main Interiors:

1. Preparation: Commercial blast cleaning conforming to SSPC-SP6.
2. Liner thickness: Nominal 40 mils, minimum 35 mils, for pipe barrel interior; minimum 6 to 10 mils at gasket groove and outside spigot end to 6-inches back from end.
3. Testing: ASTM G 62, Method B for voids and holidays; provide written certification.
4. Acceptable Lining Materials:

    a. Virgin polyethylene conforming to ASTM D 1248, with inert fillers and carbon black to resist ultraviolet degradation during storage heat bonded to interior surface of pipe and fittings; APolyline@ by American Cast Iron Pipe Company; or equal.
    b. Polyurethane: Corro-pipe II by Madison Chemicals.
    c. Ceramic Epoxy: Protecto-401 by Enduron Protective Coatings.

C. Sanitary Sewer Point Repair Pipe: For pipes which will be lined with high density polyethylene liner pipe or cured-in-place liner, provide cement-lined with seal coat in accordance with ANSI A 21.4. For pipes which will not be provided with named liner, provide pipe as specified in Paragraph 2.05B, Sanitary Sewer and Force Main Interiors.

D. Exterior: Prime coat and outside asphaltic coating conforming to ANSI A 21.10, ANSI A 21.15, or ANSI A 21.51 for pipe and fittings in open cut excavation and in casings.

E. Polyethylene Wrap: For buried water lines and sanitary sewers, including point repairs, provide polyethylene wrap unless otherwise specified or shown. Provide polyethylene wrap for buried ductile iron pipe, including polyurethane coated pipe. Conform to requirements of Division 33 - Polyethylene Wrap.

F. For flanged joints in buried service, provide petrolatum wrapping system, Denso, or equal, for the complete joint and alloy steel fasteners. Alternatively, provide bolts made of Type 304 stainless steel.

G. Pipe to be installed in potentially contaminated areas shall have coatings and linings recommended by the manufacturer as resistant to the contaminants identified in the Phase II Environmental Site Assessment Report.

2.06 MANUFACTURERS

A. Pre-approved manufacturers of ductile iron pipe are American Cast Iron Pipe Co., McWayne Cast Iron Pipe Co., and U. S. Pipe and Foundry Co.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Conform to installation requirements of Sections 33 11 00 - Water Utility Distribution Piping, and 33 31 00 – Sanitary Utility Sewerage Piping, except as modified in this Section.

B. Install in accordance with AWWA C 600 and manufacturer's recommendations.

C. Install all ductile iron pipe in polyethylene wrap, unless cathodic protection is provided. Do not use polyethylene wrap with a cathodic protection system.

3.02 GRADE

A. Unless otherwise specified on Drawings, install ductile iron pipe for water service to clear utility lines with following minimum cover:

Diameter (Inches)	Depth of Cover (Feet)
16 and 24	5
12 and smaller	4

END OF SECTION 33 06 10.15

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SECTION 33 06 40.10

HDPE SOLID AND PROFILE WALL PIPE

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. High density polyethylene (HDPE) pipe for gravity sewers and drains, including fittings.

B. High density polyethylene (HDPE) pipe for sanitary sewer force mains, including fittings.

C. High density polyethylene (HDPE) pipe for storm sewers culverts.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for HDPE pipe under this Section. Include cost in unit prices for work, as specified in Division 31.
2. Refer to Division 1 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. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Drainage Pipe, 18"-48" diameter.

B. AASHTO Section 18 - Soil Thermoplastic Pipe Interaction Systems.

C. AASHTO Section 30 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity Flow Applications.

D. ASTM D 618 - Standard Practice for Conditioning Plastics for Testing.

E. ASTM D 1248 - Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

F. ASTM D 2321 - Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Pipe.

G. ASTM D 2657 - Standard Practice for Heat Fusion Joining Polyolefin Pipe and Fittings.

H. ASTM D 2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.

I. ASTM D 3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

J. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

K. ASTM D 3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

L. ASTM F 477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

M. ASTM F 714 - Standard Specification for Polyethylene Plastic (PE) Pipe (SDR-PR) Based on Outside Diameter.

N. ASTM F 894 - Standard Specification for Polyethylene (PE) Large-Diameter Profile Wall Sewer and Drain Pipe.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit shop drawings showing design of pipe and fittings, laying dimensions, fabrication, fittings, flanges, and special details.

1.5 QUALITY CONTROL

A. Provide manufacturer's certificate of conformance to Specifications.

B. Furnish pipe and fittings that are homogeneous throughout and free from visible cracks, holes, foreign inclusions, or other injurious defects. Provide pipe as uniform as commercially practical in color, opacity, density, and other physical properties.

C. The Owner’s Representative reserves the right to inspect pipes or witness pipe manufacturing. Inspection shall in no way relieve the manufacturer of responsibility to provide products that comply with applicable standards and these Specifications.

1. Manufacturer's Notification: Should Owner’s Representative wish to witness manufacture of specific pipes, manufacturer shall provide Owner’s Representative with minimum three weeks notice of when and where production of those specific pipes will take place.
2. Failure to Inspect. Approval of products or tests is not implied by Owner’s Representative's decision not to inspect manufacturing, testing, or finished pipes.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing the products specified in this section with documented experience of minimum 5 years of pipe installations that have been in successful, continuous service for same type of service as proposed Work.

PART 2 P R O D U C T S

2.1 GENERAL

A. For sanitary sewer pipe provide HDPE pipe as follows:

1. New construction pipe products gravity sanitary sewer direct bury

INSTALLATION SPEC NO.	GENERIC NAME	TRADE NAME OR MANUFACTURER	ASTM or AASHTO	SDR (NUMERIC MAXIMUM)	PIPE STIFFNESS (NUMERIC MINIMUM)	SIZE RANGE
02505	Solid Wall Polyethylene (HDPE)	Chevron Plexco Phillip 66 Quail Poly Pipe	ASTM F-714	DR 17 DR 21	115 46	8” – 10” 12” – 48”
02531	Polyethylene Profile Wall	Spirolite	ASTM F-894	n/a	46	18”–120”

2. REHABILITATION CONSTRUCTION PIPE PRODUCTS SLIPLINING OF SANITARY SEWER

INSTALLATION SPEC NO.	GENERIC NAME	TRADE NAME OR MANUFACTURER	ASTM	SDR (NUMERIC MAXIMUM)	PIPE STIFFNESS (NUMERIC MINIMUM)	SIZE RANGE
02550	Solid Wall Poly	Chevron Plexco Quail Poly Pipe AmeriFlow by NAPCO Ameriflow by KWH	F-714	DR 21	46	8” – 48” 3” – 12” 14” – 63”
02550	Polyethylene Profile Wall	Spirolite	F-894	n/a	46	18”–120”

B. For Storm Sewer and Residential Driveway Culverts provide HDPE as follows:

1. N-12 and N-12 HC by Advanced Drainage Systems, Inc. (ADS).
2. Sure-Lok F477 by Hancor, Inc.

C. Furnish solid wall pipe with plain end construction for heat joining (butt fusion) conforming to ASTM D 2657. Utilize controlled temperatures and pressures for joining to produce fused leak-free joint.

D. Furnish profile-wall gravity sewer pipe with bell-and-spigot end construction conforming to ASTM D 3212. Joining will be accomplished with elastomeric gasket in accordance with manufacturer's recommendations. Use integral bell-and-spigot gasketed joint designed so that when assembled, elastomeric gasket, contained in machined groove on pipe spigot, is compressed radially in pipe bell to form positive seal. Design joint to avoid displacement of gasket when installed in accordance with manufacturer's recommendations.

E. Furnish solid wall pipe for sanitary sewer force mains with minimum working pressure rating of 150 psi, and with inside diameter equal to or greater than nominal pipe size indicated on Drawings.

F. Furnish corrugated polyethylene pipe (CPP) for gravity storm sewer pipe. Joints shall be installed such that connection of pipe sections will form continuous line free from irregularities in flow line. Suitable joints are:

1. Integral Bell and Spigot. Bell shall overlap minimum of two corrugations of spigot end when fully engaged conforming to the requirements of ASTM F-477.

G. Jointing:

1. Gaskets:
   a. Meet requirements of ASTM F 477. Use gasket molded into circular form or extruded to proper section and then spliced into circular form. When no contaminant is identified, use gaskets of properly cured, high-grade elastomeric compound. Basic polymer shall be natural rubber, synthetic elastomer, or blend of both.
   b. Pipes allowed to be installed in potentially contaminated areas, where free product is found near elevation of proposed sewer, shall have the following gasket materials for noted contaminants:

Contaminant	Gasket Material Required
Petroleum (diesel, gasoline)	Nitrile Rubber
Other contaminants	As recommended by pipe manufacturer

2. Lubricant. Use lubricant for assembly of gasketed joints which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.2 MATERIALS FOR SANITARY SEWER

A. Pipe and Fittings: High density, high molecular weight polyethylene pipe material meeting requirements of Type III, Class C, Category 5, Grade P34, as defined in ASTM D 1248. Material meeting requirements of cell classification in accordance with ASTM D 3350 are also suitable for making pipe products under these specifications.

B. Other Pipe Materials: Materials other than those specified in Paragraph 2.02A, Pipe and Fittings, may be used as part of profile construction, e.g., as core tube to support shape of profile during processing, provided that these materials are compatible with base polyethylene material and are completely encapsulated in finished product and in no way compromise performance of pipe products in intended use. Examples of suitable material include polyethylene and polypropylene.

2.3 MATERIALS FOR STORM SEWERS AND RESIDENTIAL DRIVEWAY CULVERTS

A. Pipe and Fittings: High density, high molecular weight polyethylene HDPE virgin compound material meeting requirements of cell class outlined in AASHTO M 294, AASHTO MP7 and ASTM D 3350.

B. Types: CPP shall meet one or both of following:

1. Type S: Outer corrugated wall with smooth inner liner.
2. Type D: Inner and outer smooth walls braced circumferentially or spirally with projections or ribs.

C. Lubricant: Use lubricant for assembly of gasketed joints, which has no detrimental effect on gasket or on pipe, in accordance with manufacturer's recommendations.

2.4 TEST METHODS FOR SANITARY SEWER

A. Conditioning. Conditioning of samples prior to and during tests is subject to approval by Owner's Representative. When referee tests are required, condition specimens in accordance with Procedure A in ASTM D 618 at 73.4 degrees F plus or minus 3.6 degrees F and 50 percent relative humidity plus or minus 5 percent relative humidity for not less than 40 hours prior to test. Conduct tests under same conditions of temperature and humidity unless otherwise specified.

B. Flattening. Flatten three specimens of pipe, prepared in accordance with Paragraph 2.05A, in suitable press until internal diameter has been reduced to 40 percent of original inside diameter of pipe. Rate of loading shall be uniform and at 2 inches per minute. Test specimens, when examined under normal light and with unaided eye, shall show no evidence of splitting, cracking, breaking, or separation of pipe walls or bracing profiles.

C. Joint Tightness. Test for joint tightness in accordance with ASTM D 3212, except replace shear load transfer bars and supports with 6-inch-wide support blocks that can be either flat or contoured to conform to pipe's outer contour.

D. Purpose of Tests. Flattening and joint tightness tests are not intended to be routine quality control tests, but rather to qualify pipe to a specified level of performance.

2.5 TEST METHODS FOR STOMR SEWERS AND RESDENTIAL DRIVEWAY CULVERTS

A. Pipe stiffness at 5 percent deflection, when determined in accordance with ASTM D 2412, shall be as specified in Section 7.4 of AASHTO M 294.

B. Minimum inner wall thickness shall be as specified in Section 7.2.2 of AASHTO M 294.

2.6 MARKING

A. Mark each standard and random length of pipe in compliance with these Specifications with following information:

1. Pipe size.
2. Pipe class.
3. Production code.
4. Material designation.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Conform to requirements of Division 33.

B. Install pipe in accordance with the manufacturers recommended installation procedures.

C. HDPE pipe is not approved in applications requiring augering of pipe.

D. Bedding and backfill: Conform to requirements of Division 31.

END OF SECTION 33 06 40.10

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SECTION 33 06 40.11

REINFORCED CONCRETE PIPE

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Reinforced concrete pipe for storm sewers.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for reinforced concrete pipe under this Section. Include cost in unit price work as specified in the following Sections:

a. 33 41 00 – Storm Utility Drainage Piping

B. 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.

1.03 REFERENCES

A. ASTM C 76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

B. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe.

C. ASTM C 497 - Method of Testing Concrete Pipe, Sections, or Tile.

D. ASTM C 506 - Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.

E. ASTM C 507 - Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.

F. ASTM C 655 - Reinforced Concrete D-load Culvert, Storm Drain and Sewer Pipe.

G. ASTM C 822 - Standard Definitions and Terms Relating to Concrete Pipe and Related Products.

H. ASTM C 877 - Standard Specification for External Sealing Bands for Non circular Concrete Sewer, Storm Drain, and Culvert Pipe.

1.04 SUBMITTALS

A. Submittals shall conform to requirements in Division 1.

B. Submit complete product data for pipe, fittings and gaskets for approval. Indicate conformance to appropriate reference standards.

C. Submit certificates by a testing laboratory, hired and paid by the manufacturer, that concrete pipes meet applicable standards when tested in accordance with ASTM C 497.

PART 2 P R O D U C T S

2.01 REINFORCED CONCRETE PIPE

A. Circular reinforced concrete pipe shall conform to requirements of ASTM C 76, for Class III wall thickness. Joints shall be rubber gasketed conforming to ASTM C 443.

B. Reinforced concrete arch pipe shall conform to the requirements of ASTM C 506 for Class A-III. Joints shall conform to ASTM C 877.

C. Reinforced concrete elliptical pipe, either vertical or horizontal, shall conform to the requirements of ASTM C 507 for Class VE-III for vertical or Class HE-III for horizontal. Joints shall be rubber gaskets conforming to ASTM C 877.

D. Reinforced concrete D-load pipe shall conform to the requirements of ASTM C 655.

2.02 GASKETS

A. When no contaminant is identified, furnish rubber gasket conforming to ASTM C 443 for circular reinforced concrete pipe and rubber gasket conforming to ASTM C 877 for reinforced concrete elliptical pipe.

B. Pipes to be installed in potentially contaminated areas, especially where free product is found near the elevation of the proposed sewer, shall have the following gasket materials for the noted contaminants:

CONTAMINANT	GASKET MATERIAL REQUIRED
Petroleum (diesel, gasoline)	Nitrile Rubber
Other Contaminants	As recommended by the pipe manufacturer

2.03 SOURCE QUALITY CONTROL

A. Representatives of Engineer will inspect manufacturer's plant and casting operations as deemed necessary.

PART 3 E X E C U T I O N

3.01 INSTALLATION

A. Conform to requirements of the following Sections, as applicable:

1. 33 41 00 - Storm Utility Drainage Piping

B. Install reinforced concrete pipe in accordance with manufacturer's recommendations.

END OF SECTION 33 06 40.11

SECTION 33 11 00
WATER UTILITY DISTRIBUTION PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Installation of water lines.

B. Specifications identify requirements for both small diameter water lines and large diameter water lines. When specifications for large diameter water lines differ from those for small diameter water lines, large diameter specifications will govern for large diameter pipe.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for water lines installed by open-cut, augered with or without casing, aerial crossing, and pipe offset section or within limits of Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis for each size of pipe installed. Separate pay items are used for each type of installation.
   a. Mains: Measure along axis of pipe and include fittings and valves.
   b. Branch Pipe: Measure from axis of water line to end of branch.
2. Payment for interconnection is on lump sum basis for each interconnection identified on Drawings. Payment will include tapping sleeve and valves piping, connections and other related work necessary for construction as shown on Drawings or specified herein.
3. Payment for removal of existing internal elliptical or dished head plug is on unit price basis for each internal elliptical or dished head plug removed. Payment will include deletion of plug, drainage or dewatering of water lines, repair of damaged linings, rechlorination and items incidental to operation.
4. Payment for plug and clamp is on a unit price basis for each size of pipe.
5. Payment for drainline connection with service manhole is on unit price basis for each drainline shown on drawings. Payment includes valve, access manhole and connection.
6. Payment for cylindrical corrosion barriers is on a unit price basis for each pipe fitting installed with one or more barriers.
7. When directed by Owner’s Representative to install extra fittings as required to avoid unforeseen obstacles, payment will be based on the following:
   a. Each extra fitting requested by Owner’s Representative and delivered to jobsite will be paid according to unit price for "Extra Fittings in Place."
   b. Payment will include and be full compensation for items necessary for installation and operation of water line.
8. Refer to Division 1 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. ANSI A 21.11/AWWA C111 - Standard for Rubber-Gasket Joints for Ductile - Iron Pressure Pipe and Fittings

B. ANSI/NSF Standard 61 - Drinking Water System -Health Components

C. ASTM A 36 - Standard Specification for Carbon Structural Steel

D. ASTM A 536 - Standard Specification for Ductile Iron Castings

E. ASTM A 126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

F. ASTM B 21 - Standard Specification for Naval Brass Rod, Bar, and Shapes

G. ASTM B 98 - Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes

H. ASTM B 301 - Standard Specification for Free-Cutting Copper Rod and Bar

I. ASTM B 584 - Standard Specification for Copper Alloy Sand Casting for General Application.

J. ASTM E 165 - Standard Test Method for Liquid Penetrant Examination

K. ASTM E 709 - Standard Guide for Magnetic Particle Examination

L. ASTM F 1674 - Standard Test Method for Joint Restraint Products for Use with PVC Pipe

M. AWWA C 206 - Standard for Field Welding of Steel Water Pipe

N. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 Inches through 144 Inches

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Conform to submittal requirements of applicable Section for type of pipe used.

C. Submit Lone Star notification transmittal number prior to beginning excavation.

D. Submit, a minimum of 15 days before beginning pipe laying operations, layout drawing identifying proposed sections for disinfecting, hydrostatic testing and site restoration for entire project for review and approval. Layout drawing to identify sequence of sections for:

1. Disinfection; not to exceed 4,000 linear feet per section.
2. Hydrostatic testing and transfer of services; to immediately follow sequence of disinfected section.
3. Site restoration; not to exceed limits specified; Sequence in order of disturbance.

PART 2 P R O D U C T S

2.1 PIPE MATERIALS

A. Install pipe materials which conform to Division 33.

B. Conform to American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 61 and have certified by an organization accredited by ANSI.

C. Type of pipe materials used is Contractor's option unless specifically identified on Drawings.

D. Provide minimum of 3/8 inch inside joint recess between ends of pipe in straight pipe sections.

2.2 WELDED JOINT PROTECTION FITTING FOR SMALL DIAMETER STEEL PIPE

A. Cylindrical Corrosion Barrier: Provide approved cylindrical corrosion barrier.

B. O-rings: Conform to National Sanitary Foundation requirements.

2.3 RESTRAINED JOINTS

A. Ductile-Iron Pipe: See Division 33.

B. PVC Pipe: See Division 33. Perform hydrostatic testing in accordance with ASTM F 1674.

C. Prestressed Concrete Cylinder Pipe, Bar-Wrapped Pipe and Steel Pipe: Welded joints (see Paragraph 3.06 D).

D. Restrained Joints where required on DIP and PVC pipe:

1. Restraint devices: Manufacture of high strength ductile iron, ASTM A 536 up to 24 inches, and ASTM A 36 for sizes greater than 30 inches. Working pressure rating twice that of design test pressure.
2. Bolts and connecting hardware: High strength low alloy material in accordance with ANSI A21.11/AWWA C111.

2.4 COUPLINGS AND APPURTENANCES FOR LARGE DIAMETER WATERLINE

A. Flexible (Dresser-type) Couplings.

1. Install where shown on Drawings or where allowed by Owner’s Representative for Contractor's convenience. Use galvanized flexible couplings when installed on galvanized pipe which is cement lined, or when underground. Provide gaskets manufactured from Neoprene or Buna-N.
2. For steel pipe; provide approved sleeve-type flexible couplings. Thickness of middle ring equal to or greater than thickness of pipe wall.
3. Provide approved flanged adapter couplings for steel pipe.
4. Use Type 316 stainless steel bolts, nuts and washers where flexible couplings are installed underground. Coat entire coupling with 20-mil of approved coal tar coating.

B. Flap Valves: Provide approved flap valves on discharge of manhole drainline as shown on Drawings.

1. Body and Flap: ASTM A 126-B cast iron.
2. Seats: ASTM B 21-CA482 or ASTM B 301-CA145 bronze.
3. Resilient Seat
4. Hinge Arms: ASTM B 584-CA865 high tensile bronze.
5. Hinge pins: ASTM B 98-CA655 silicon bronze.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Conform to applicable installation specifications for types of pipe used.

B. Employ workmen who are skilled and experienced in laying pipe of type and joint configuration being furnished. Provide watertight pipe and pipe joints.

C. Lay pipe to lines and grades shown on Drawings.

D. Confirm that nine feet minimum separation from gravity sanitary sewers and manholes or separation of four feet minimum from force mains as specified in this Section in all directions unless special design is provided on Drawings.

E. Where above clearances cannot be attained, and special design has not been provided on Drawings, obtain direction from Owner's Representative before proceeding with construction.

F. Inform Owner's Representative if unmetered sprinkler or fire line connections exist which are not shown on Drawings. Make transfer only after approval by Owner's Representative.

G. For projects involving multiple subdivisions or locations, limit water line installation to maximum of two project site locations. Maximizing 2 pipe installation crews shall be permitted, unless otherwise approved by Owner's Representative.

H. Only the appropriate governing agency will handle operations involving opening and closing valves for wet connections and for chlorination. Contractor is responsible for handling necessary installations and removal of chlorination and testing taps and risers.

I. If asbestos-cement (A.C.) pipe is encountered, follow safety practices outlined in American Water Works Association's publication, "Work Practices for A/C Pipe". Strictly adhere to "recommended practices" contained in this publication and make them "mandatory practices" for this Project.

J. For pipe diameters 36 inches and greater, clearly mark each section of pipe and fitting with unique designation on inside of pipe along with pressure class. Locate unique identifying mark minimum of five feet away from either end of each section of pipe. Provide one unique identifying mark in middle of each fitting. Place markings at consistent locations. Use permanent black paint and minimum letter height of 4 inches to mark designations.

K. Contractor is responsible for assuring chosen manufacturer fulfills requirements for extra fittings and, therefore, is responsible for costs due to downtime if requirements are not met.

L. Do not remove plugs or clamps during months of peak water demands; June, July and August, unless otherwise approved by Owner's Representative.

3.2 HANDLING, CLEANING AND INSPECTION

A. Handling:

1. Place pipe along project site where storm water or other water will not enter or pass through pipe.

2. Load, transport, unload, and otherwise handle pipe and fittings to prevent damage of any kind. Handle and transport pipe with equipment designed, constructed and arranged to prevent damage to pipe, lining and coating. Do not permit bare chains, hooks, metal bars, or narrow skids or cradles to come in contact with coatings. Where required, provide pipe fittings with sufficient interior strutting or cross bracing to prevent deflection under their own weight.
3. Hoist pipe from trench side into trench by means of sling of smooth steel cable, canvas, leather, nylon or similar material.
4. For large diameter water lines, handle pipe only by means of sling of canvas, leather, nylon, or similar material. Sling shall be minimum 36 inches in width. Do not tear or wrinkle tape layers.
5. Use precautions to prevent injury to pipe, protective linings and coatings.
   a. Package stacked pipe on timbers. Place protective pads under banding straps at time of packaging.
   b. Pad fork trucks with carpet or other suitable material. Use nylon straps around pipe for lift when relocating pipe with crane or backhoe.
   c. Do not lift pipe using hooks at each end of pipe.
   d. Do not place debris, tools, clothing, or other materials on pipe.
6. Repair damage to pipe or protective lining and coating before final acceptance.
7. For cement mortar line and coated steel pipe and PCCP, permit no visible cracks longer than 6 inches, measured within 15 degrees of line parallel to pipe longitudinal axis of finished pipe, except:
   a. In surface laitance of centrifugally cast concrete.
   b. In sections of pipe with steel reinforcing collars or wrappers.
   c. Within 12 inches of pipe ends.
8. Reject pipe with visible cracks (not meeting exceptions) and remove from project site.

B. Cleaning: Thoroughly clean and dry interior of pipe and fittings of foreign matter before installation and keep interior clean until Work has been accepted. Keep joint contact surfaces clean until jointing is completed. Do not place debris, tools, clothing or other materials in pipe. After pipe laying and joining operations are completed, clean inside of pipe and remove debris.

C. Inspection: Before installation, inspect each pipe and fitting for defects. Reject defective, damaged, or unsound pipe and fittings and remove them from site.

3.3 EARTHWORK

A. Conform to applicable provisions of Division 31.

B. Bedding: Use bedding materials in conformance with Division 31.

C. Backfill: Use bank run sand or earth or native soil as specified in Division 31. Backfill excavated areas in same day excavated. When not possible, cover excavated areas using steel plates on paved areas and other protective measures elsewhere.

D. Place material in uniform layers of prescribed maximum loose thickness and wet or dry material to approximately optimum moisture content. Compact to prescribed density Water tamping is not allowed.

E. Pipe Embedment: Including 6-inch pipe bedding and backfill to 12 inches above top of pipe.

3.4 PIPE CUTTING

A. Cut pipe 12 inches and smaller with standard wheel pipe cutters. Cut pipe larger than 12 inches in manner approved by Owner's Representative. Make cuts smooth and at right angles to axis of pipe. Bevel plain end with heavy file or grinder to remove sharp edges.

3.5 PIPING INSTALLATION

A. General Requirements:

1. Lay pipe in subgrade free of water.
2. Make adjustments of pipe to line and grade by scraping away subgrade or filling in with granular material.
3. Properly form bedding to fully support bell without wedging or blocking up bell.
4. Open Cut Construction: Keep pipe trenches free of water which might impair pipe laying operations. Grade pipe to provide uniform support along bottom of pipe. Excavate for bell holes after bottom has been graded and in advance of placing pipe. Lay not more than nominal city block length of not more than 300 feet of pipe in trench ahead of backfilling operations. Cover or backfill laid pipe if pipe laying operations are interrupted and during non-working hours. Place backfill carefully and simultaneously on each side of pipe to avoid lateral displacement of pipe and damage to joints. If adjustment of pipe is required after it has been laid, remove and re-lay as new pipe.

B. Install pipe continuously and uninterrupted along each street on which work is to be performed. Obtain approval of Owner's Representative prior to skipping any portion of Work.

C. Protection of Pipeline: Securely place stoppers or bulkheads in openings and in end of line when construction is stopped temporarily and at end of each day's work.

D. Perform Critical Location as shown on Drawings. Refer to Division 33 for additional requirements at critical locations.

E. Laying Large Diameter Water Line

1. Lay not more than 50 feet of pipe in trench ahead of backfilling operations.
2. Dig trench proper width as shown. When trench width below top of pipe becomes 4 feet wider than specified, install higher class of pipe or improved bedding, as determined by Owner's Representative. No additional payment will be made for higher class of pipe or improved bedding.
3. Use adequate surveying methods and equipment; employ personnel competent in use of this equipment. Horizontal and vertical deviations from alignment as indicated on Drawings shall not exceed 0.10 feet. Measure and record "as-built" horizontal alignment and vertical grade at maximum of every 100 feet on record drawings.
4. Prevent damage to coating when placing backfill. Use backfill material free of large rocks or stones, or other material which could damage coatings.
5. Before assembling couplings, lightly coat pipe ends and outside of gaskets with cup grease or liquid vegetable soap to facilitate installation.
6. Prior to proceeding with critical tie-ins submit sequence of work based on findings from "critical location" effort.

F. Perform following additional procedures when working on plant sites.

1. Seventy-two hours prior to each plant shut down or connection, schedule coordination meeting with Owner's Representative and Water Production personnel. At this meeting, present proposed sequencing of Work and verification of readiness to complete Work as required and within time permitted. Do not proceed with Work until Owner's Representative agrees key personnel, equipment and materials are on hand to complete Work.
2. Prior to fully excavating around existing piping, excavate as minimal as possible to confirm type and condition of existing joints. Verify size, type, and condition of pipe prior to ordering materials or fully mobilizing for Work.
3. Do not proceed with connections to existing piping and identified critical stages of work unless approved by Owner's Representative and the governing agency is present to observe.
4. Coordinate with the governing agency to obtain reduction in operating pressures prior to performing connections to existing piping.
5. Make connections to existing piping only when two valves are closed off between connection and source of water pressure. Do not make connection relying solely on one valve, unless otherwise approved by Owner's Representative.
6. Perform critical stages of Work identified on Drawings at night or during low water demand months as specified in Division 1.
7. Excavation equipment used on plant sites to have smooth bucket; no teeth or side cutters.
8. Submit to Owner's Representative Lone Star Notification transmittal number prior to beginning excavation.
9. Before each "dig" with mechanical excavator, probe ground to determine potential obstructions. Repeat procedure until existing pipe is located or excavation reaches desired elevation. Perform excavations within one foot to existing piping by hand methods.
10. Provide adequate notice to pipe manufacture's representative when connecting or modifying existing prestressed or pretension concrete cylinder pipe.
11. Provide field surveyed (horizontal and vertical elevations) "as-builts" of new construction and existing underground utilities encountered. Submit in accordance with Division 1.
12. Prior to performing plant work to be done on weekend, provide list of sites and contact person with phone numbers to Owner's Representative by noon on Thursday of week. Contact person must be accessible during weekend, have Houston Metro Area phone number, and be authorized to make emergency decisions.
13. No night work or plant shut down will be scheduled to begin two working days before or after designated Holidays.

G. For tie-ins to existing water lines, provide necessary material on hand to facilitate connection prior to shutting down existing water line. Provide governing agency a minimum of two weeks notice prior to shutting down existing water line.

3.6 JOINTS AND JOINTING

A. Rubber Gasketed Bell-and-Spigot Joints for Concrete Cylinder Pipe, Bar Wrapped Pipe PVC, Steel, and DIP:

1. After rubber gasket is placed in spigot groove of pipe, equalize rubber gasket cross section by inserting tool or bar recommended by manufacturer under rubber gasket and moving it around periphery of pipe spigot.
2. Lubricate gaskets with nontoxic water-soluble lubricant before pipe units are joined.

3. Fit pipe units together in manner to avoid twisting or otherwise displacing or damaging rubber gasket.
4. After pipe sections are joined, check gaskets to ensure that no displacement of gasket has occurred. If displacement has occurred, remove pipe section and remake joint as for new pipe. Remove old gasket, inspect for damage and replace if necessary before remaking joint.
5. Where preventing movement of 16-inch diameter or greater pipe is necessary due to thrust, use restrained joints as shown on Drawings.
   a. Include buoyancy conditions for soil unit weight when computing thrust restraint calculations.
   b. Do not include passive resistance of soil in thrust restraint calculations.
6. Except for PVC pipe, provide means to prevent full engagement of spigot into bell as shown on Drawings. Means may consist of wedges or other types of stops as approved by Owner's Representative.

B. Flanged Joints where required on Concrete Cylinder Pipe, Bar Wrapped Pipe, Ductile Iron Pipe, or Steel Pipe:

1. AWWA C 207. Prior to installation of bolts, accurately center and align flanged joints to prevent mechanical prestressing of flanges, pipe and equipment. Align bolt holes to straddle vertical, horizontal or north-south center line. Do not exceed 3/64 inch per foot inclination of flange face from true alignment.
2. Use full-face gaskets for flanged joints. Provide 1/8-inch-thick cloth inserted rubber gasket material. Cut gaskets at factory to proper dimensions.
3. Use galvanized or black nuts and bolts to match flange material. Use cadmium-plated steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Maintain at all times approximately same distance between two flanges at points around flanges. Tighten bolts alternately (180° apart) until all are evenly tight. Draw bolts tight to ensure proper seating of gaskets. Provide Densco petroleum based tape or approved equal for all exposed portions of nuts, bolts and pipe.
4. Full length bolt isolating sleeves and washers shall be used with flanged connections. Furnish kits in accordance with City of Houston's "Approved Products List."
5. For in-line flange joints 30 inches in diameter and greater and at butterfly valve flanges, provide Pyrox G-10 with nitrite seal, conforming to ANSI A 21.11 mechanical joint gaskets. For in-line flange joints sized between 12 inches in diameter and greater and 24 inches in diameter and smaller, provide Phenolic PSI with nitrite seal gasket conforming to ANSI A 21.11 mechanical joint gaskets.

C. Welded Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Prior to starting work, provide certification of qualification for welders employed on project for type of work procedures and positions involved.
2. Joints: AWWA C 206. Full-fillet, single lap-welded slip-type either inside or outside, or double butt-welded type; use automatic or hand welders; completely penetrate deposited metal with base metal; use filler metal compatible with base metal; keep inside of fittings and joints free from globules of weld metal which would restrict flow or become loose. Do not use mitered joints. For interior welded joints, complete backfilling before welding. For exterior field-welded joints, provide adequate working room under and beside pipe. Use exterior welds for 30-inch and smaller.
3. Furnish welded joints with trimmed spigots and interior welds for 36-inch and larger pipe.
4. Bell-and-spigot, lap-welded slip joints: Deflection may be taken at joint by pulling joint up to 3/4 inch as long as 1 ½ inch minimum lap is maintained. Spigot end may be miter cut to take deflections up to 5 degrees as long as joint tolerances are maintained. Miter end cuts of both ends of butt-welded joints may be used for joint

deflections of up to 5 degrees. Align piping and equipment so that no part is offset more than 1/8 inch. Set fittings and joints square and true, and preserve alignment during welding operation. For butt welded joints, align abutting ends to minimize offset between surfaces. For pipe of same nominal wall thickness, do not exceed 1/16 inch offset. Use line-up clamps for this purpose; however, take care to avoid damage to linings and coatings.

5. Protect coal-tar-epoxy lining during welding by draping an 18-inch-wide strip of heat resistant material over top half of pipe on each side of lining holdback to avoid damage to lining by hot splatter. Protect tape coating similarly if external welding is required.
6. Welding rods: Compatible with metal to be welded to obtain strongest bond, E-70XX.
7. Deposit metal in successive layers to provide at least 2 passes or beads for automatic welding and 3 passes or beads for manual welding in completed weld.
8. Deposit no more than 1/4 inch of metal on each pass. Thoroughly clean each individual pass with wire brush or hammer to remove dirt, slag or flux.
9. Do not weld under weather condition that would impair strength of weld, such as wet surface, rain or snow, dust or high winds, unless work is properly protected.
10. Make tack weld of same material and by same procedure as completed weld. Otherwise, remove tack welds during welding operation.
11. Remove dirt, scale, and other foreign matter from inside piping before tying in sections, fittings, or valves.
12. Welded Joints for Large Diameter Water Lines:
    a. Furnish pipe with trimmed spigots and interior welds for 36-inch and larger pipe.
    b. Use exterior welds for 30 inch and smaller.
    c. Only one end may be miter cut. Miter end cuts of both ends of butt-welded joints may be used for joint deflections of up to 2 ½ degrees.
    d. For large diameter water lines, employ an independent certified testing laboratory, approved by Owner's Representative, to perform weld acceptance tests on welded joints. Include cost of such testing and associated work to accommodate testing in contract unit price bid for water line. Furnish copies of test reports to Owner's Representative for review. Owner's Representative has final decision as to suitability of welds tested.
        1) Weld acceptance criteria:
            a) Conduct in accordance with ASTM E165- Standard Test Method for Liquid Penetrant Examination and ASTM E709 Standard Guide for Magnetic Particle Examination. Use X-ray methods for butt welds, for 100 percent of joint welds.
            b) Examine welded surfaces for the following defects:
                (1) Cracking
                (2) Lack of fusion/penetration
                (3) Slag which exceeds one-third (t) where (t) equals material thickness
                (4) Porosity/Relevant rounded indications greater than 3/16 inch; rounded indication is one of circular or elliptical shape with length equal to or less than three times its width
                (5) Relevant linear indications in which length of linear indication exceeds three times its width
                (6) Four or more relevant 1/16-inch rounded indications in line separated by 1/16 inch or less edge to edge
13. After pipe is joined and prior to start of welding procedure, make spigot and bell essentially concentric by jacking, shimming or tacking to obtain clearance tolerance around periphery of joint except for deflected joints.
14. Furnish each welder employed steel stencil for marking welds, so work of each welder can be identified. Mark pipe with assigned stencil adjacent to weld. When welder leaves job, stencil must be voided and not duplicated. Welder making defective welds

must discontinue work and leave project site. Welder may return to project site only after recertification.

15. Provide cylindrical corrosion barriers for epoxy lined steel pipe 24-inch diameter and smaller, unless minimum wall thickness is 0.5 inches or greater.
    a. In addition to welding requirements contained here in Paragraph 3.06, conform to protection fitting manufacturer's installation recommendations.
    b. Provide services of technical representative of manufacturer available on site at beginning of pipe laying operations. Representative to train welders and advise regarding installation and general construction methods. Welders must have 12 months prior experience installing protection fittings.
    c. All steel pipe is to have cutback 3/4 inch to no greater than 1 inch of internal diameter coating from weld bevel.
    d. Furnish steel fittings with cylindrical corrosion barriers with shop welded extensions to end of fittings. Extension length to measure no less than diameter of pipe. Shop apply lining in accordance with AWWA C 210 or AWWA C 213.
    e. All steel pipe receiving field adjustments are to be cold cut using standard practices and equipment. No cutting using torch is to be allowed.

D. Harnessed Joints (Concrete Cylinder Pipe, Bar Wrapped Pipe):

1. Use of snap-ring type restrained joints on pipe is limited to 20-inch through 48-inch diameters.
2. Position snap-ring joint bolt on top (12 o'clock portion). Provide minimum 1/2-inch joint recess. Use joint "diapers" minimum of 12 inches wide.
3. For field adjustments with deflections beyond manufacturer's recommendations:
    a. Field trim spigot.
    b. Do not engage ring.
4. Harnessed joints are not permitted in areas defined on Drawings as potentially petroleum contaminated material, in tunnels, or at bend greater than 5 degrees.
5. Install harness type joints including snap rings at straight sections of pipe.

E. Restrained Joints

1. For existing water lines and water lines less than 16 inches in diameter, restrain pipe joints with concrete thrust blocks.
2. Thrust restraint lengths shown on Drawings are minimum anticipated lengths. These lengths are based on deflections indicated and on use of prestressed concrete cylinder pipe for large diameter lines and ductile iron pipe for small diameter lines. Adjustments in deflections or use of other pipe material may result in reduction or increase of thrust lengths. Perform calculations by pipe manufacturer to verify proposed thrust restraint lengths. Submit calculations for all pipe materials sealed by a registered Professional Engineer in State of Texas for review by Owner’s Representative. Make adjustments in thrust restraint lengths at no additional cost to Owner.
3. Passive resistance of soil will not be permitted in calculation of thrust restraint.
4. For 16-inch lines and larger use minimum 16-foot length of pipe in and out of joints made up of beveled pipe where restraint joint lengths are not identified on Drawings. Otherwise, provide restraint joints for a minimum length of 16 feet on each side of beveled joints.
5. Installation.
    a. Install restrained joints mechanism in accordance with manufacturer's recommendations.
    b. Examine and clean mechanism; remove dirt, debris and other foreign material.
    c. Apply gasket and joint NSF 61 FDA food grade approved lubricant.

d. Verify gasket is evenly seated.
e. Do not over stab pipe into mechanism.

6. Prevent any lateral movement of thrust restraints throughout pressure testing and operation.
7. Place 2500 psi concrete conforming to Division 32, for blocking at each change in direction of existing water lines, to brace pipe against undisturbed trench walls. Finish placement of concrete blocking, made from Type I cement, 4 days prior to hydrostatic testing of pipeline. Test may be made 2 days after completion of blocking if Type II cement is used.

F. Joint Grout (Concrete Cylinder Pipe, Bar Wrapped Pipe, Steel Pipe):

1. Mix cement grout mixture by machine except when less than 1/2 cubic yard is required. When less than 1/2 cubic yard is required, grout may be hand mixed. Mix grout only in quantities for immediate use. Place grout within 20 minutes after mixing. Discard grout that has set. Retempering of grout by any means is not permitted.
2. Prepare grout in small batches to prevent stiffening before it is used. Do not use grout which has become so stiff that proper placement cannot be assured without retempering. Use grout for filling grooves of such consistency that it will adhere to ends of pipe.
3. Surface Preparation: Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces with wire brush or hammer to sound, clean surface. Remove rust and foreign materials from metal surfaces in contact with grout.
4. Follow established procedures for hot and cold weather concrete placement.
5. Complete joint grout operations and backfilling of pipe trenches as closely as practical to pipe laying operations. Allow grouted exterior joints to cure at least 1 hour before compacting backfill.
6. Grouting exterior joint space: Hold wrapper in place on both sides of joint with minimum 5/8-inch-wide steel straps or bands. Place no additional bedding or backfill material on either side of pipe until after grout band is filled and grout has mechanically stiffened. Pull ends of wrapper together at top of pipe to form access hole. Pour grout down one side of pipe until it rises on other side. Rod or puddle grout to ensure complete filling of joint recess. Agitate for 15 minutes to allow excess water to seep through joint band. When necessary, add more grout to fill joint completely. Protect gap at top of joint band from backfill by allowing grout to stiffen or by covering with structurally protective material. Do not remove band from joint. Proceed with placement of additional bedding and backfill material.
7. Interior Joints for Pipe 24 inches and Smaller: Circumferentially butter bell with grout prior to insertion of spigot, strike off flush surplus grout inside pipe by pulling filled burlap bag or inflated ball through pipe with rope. After joint is engaged, finish off joint grout smooth and clean. Use swab approved by Owner’s Representative for 20-inch pipe and smaller.
8. Protect exposed interior surfaces of steel joint bands by metallizing, by other approved coatings, or by pointing with grout. Joint pointing may be omitted on potable water pipelines if joint bands are protected by zinc metallizing or other approved protective coatings.
9. Remove and replace improperly cured or otherwise defective grout.
10. Strike off grout on interior joints and make smooth with inside diameter of pipe.
11. When installed in tunnel or encasement pipe and clearance within casing does not permit outside grout to be placed in normal manner, apply approved flexible sealer, such as Flex Protex or equal, to outside joint prior to joint engagement. Clean and prime surfaces receiving sealer in accordance with manufacturer's recommendations. Apply sufficient quantities of sealer to assure complete protection of steel in joint area. Fill interior of joint with grout in normal manner after joint closure.

12. Interior Joints for Water Lines 30 inches and Larger: Clean joint space, wet joint surfaces, fill with stiff grout and trowel smooth and flush with inside surfaces of pipe using steel trowel so that surface is smooth. Accomplish grouting at end of each work day. Obtain written acceptance from Owner's Representative of inside joints before proceeding with next day's pipe laying operation. During inspection, insure no delamination of joint mortar has occurred by striking joint mortar lining with rubber mallet. Remove and replace delaminated mortar lining.
13. Work which requires heavy equipment to be over water line must be completed before mortar is applied to interior joints.

G. Large Diameter Water Main Joint Testing: In addition to testing individual joints with feeler gauge approximately 1/2 inch wide and 0.015-inch thick, use other joint testing procedure approved or recommended by pipe manufacturer which will help ensure watertight installation prior to backfilling. Perform tests at no additional cost to Owner.

H. Make curves and bends by deflecting joints or other method as recommended by manufacturer and approved by Owner's Representative. Submit details of other methods of providing curves and bends which exceed manufacturer's recommended deflection prior to installation.

1. Deflection of pipe joints shall not exceed maximum deflection recommended by pipe manufacturer, unless otherwise indicated on Drawings.
2. If deflection exceeds that specified but is less than 5 percent, repair entire deflected pipe section such that maximum deflection allowed is not exceeded.
3. If deflection is equal to or exceeds 5 percent from that specified, remove entire portion of deflected pipe section and install new pipe.
4. Replace, repair, or reapply coatings and linings as required.
5. Assessment of deflection may be measured by Owner's Representative at location along pipe. Arithmetical averages of deflection or similar average measurement methods will not be deemed as meeting intent of standard.
6. When rubber gasketed pipe is laid on curve, join pipe in straight alignment and then deflect to curved alignment.

I. Closures Sections and Approved Field Modifications to Steel, Concrete Cylinder Pipe, Bar Wrapped Pipe and Fittings:

1. Apply welded-wire fabric reinforcement to interior and exterior of exposed interior and exterior surfaces greater than 6 inches in diameter. Welded-wire fabric: minimum W1; maximum spacing 2 inches by 4 inches; 3/8 inch from surface of steel plate or middle third of lining or coating thickness for mortar thickness less than 3/4 inch.
2. Fill exposed interior and exterior surfaces with nonshrink grout.
3. For pipe diameters 36 inches and greater, perform field welds on interior and exterior of pipe.
4. For large diameter water lines, provide minimum overlap of 4 inches of butt strap over adjacent piece on butt-strap closures.

3.7 CATHODIC PROTECTION APPURTENANCES

A. Where identified on Drawings, modify pipe for cathodic protection as detailed on Drawings and specified. Unless otherwise noted, provide insulation kits including test stations at connections to existing water system or at locations to isolate one type of cathodic system from another type, between water line, access manhole piping and other major openings in water line, or as shown on Drawings.

B. Bond joints for pipe installed in tunnel or open cut, except where insulating flanges are provided. Weld strap or clip between bell and spigot of each joint or as shown on Drawings. No additional bonding required where joints are welded for thrust restraint. Repair coatings as specified by appropriate AWWA standard, as recommended by manufacturer, and as approved by Owner's Representative.

C. Bonding Strap or Clip: Free of foreign material that may increase contact resistance between wire and strap or clip.

3.8 SECURING, SUPPORTING AND ANCHORING

A. Support piping as shown on Drawings and as specified in this Section, to maintain line and grade and prevent transfer of stress to adjacent structures.

B. Where shown on Drawings, anchor pipe fittings and bends installed on water line by welding consecutive joints of pipe together to distance each side of fitting. Restrained length, as shown on Drawings, assumes that installation of pipe and subsequent hydrostatic testing begins upstream and proceed downstream, with respect to normal flow of water in pipe. If installation and testing differs from this assumption, submit for approval revised method of restraining pipe joints upstream and downstream of device used to test against (block valve, blind flange or dished head plug).

C. Use adequate temporary blocking of fittings when making connections to distribution system and during hydrostatic tests. Use sufficient anchorage and blocking to resist stresses and forces encountered while tapping existing water line.

3.9 POLYETHYLENE WRAP FOR DUCTILE IRON PIPE

A. Double wrap pipe and appurtenances (except fire hydrants and fusion bond or polyurethane coated fittings) with 8-mil polyethylene film.

B. Do not use polyethylene wrap if pipe is cathodically protected.

C. Conform to requirements of Division 33.

3.10 CLEANUP AND RESTORATION

A. Provide cleanup and restoration crews to work closely behind pipe laying crews, and where necessary, during disinfection and hydrostatic testing, service transfers, abandonment of old water lines, backfill and surface restoration.

B. Unless otherwise approved by Owner's Representative, comply with the following:

1. Once water line is installed to limits approved in layout submitted, immediately begin preparatory work for disinfection effort.
2. No later than three days after completing disinfection preparatory work, execute disinfection work.
3. Immediately after transfer of services, begin abandonment of old water lines and site restoration.
4. Do not exceed a total of 50% of total project linear feet of disturbed right-of-way and easement until site is restored in accordance with Division 1.
5. Exceeding any of the above footage limitations shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

C. For large diameter water lines, do not install more than 2,000 linear feet of water line, without previous 2,000 linear feet being restored in accordance with Division 1. Schedule paving crews so repaving work will not lag behind pipe laying work by more than 1,000 linear feet. Failure to comply with this requirement shall be considered a material breach of the Contract and subject to termination in accordance with the General Conditions.

3.11 CLEANING PIPING SYSTEMS

A. Remove construction debris or foreign material and thoroughly broom clean and flush piping systems. Provide temporary connections, equipment and labor for cleaning. Owner's Representative must inspect water line for cleanliness prior to filling.

3.12 DISINFECTION OF WATER LINES

A. Conform to requirements of Division 33.

3.13 FIELD HYDROSTATIC TESTS

A. Conform to requirements of Division 33.

END OF SECTION 33 11 00

SECTION 33 12 13.10
TAPPING SLEEVES AND VALVES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Tapping sleeves and valves for connections to existing water system.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on unit price basis for each tap installed.
2. Refer to Division 1 for unit price procedures.
3. For water lines 4-inches and greater, no payment will be made until coupon (cut out portion of pipe tapped) is delivered to the Owner.

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 A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

B. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

C. ASTM A194 Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service.

D. AWWA C 110 - Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in., for Water and other Liquids.

E. AWWA C 200 - Standard for Steel Water Pipe - 6 in. and Larger.

F. AWWA C 207 - Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 in. through 144 in.

G. AWWA C 500 - Standard for Metal Seated Gate Valves, for Water Supply Service.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit results of tapping sleeves NPT test opening.

C. Submit manufacturer's affidavit as required in Division1.

1.5 DELIVERY, STORAGE AND HANDLING

A. Ship steel sleeves in wooden crates that provide protection from damage to epoxy coating during transport and storage.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Tapping Sleeves:

1. Tapping Sleeve Bodies: AWWA C 110 cast or ductile iron or AWWA C 200 carbon steel in two sections to be bolted together with high-strength, corrosion-resistant, low-alloy steel bolts with mechanical joint ends.
2. Branch Outlet of Tapping Sleeve:
   a. Flanged, machined recess, AWWA C 207, Class D, ANSI 150 pound drilling.
   b. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
3. Use cast iron split sleeve where fire service from 6-inch water line is approved.

B. Welded-steel tapping-sleeve bodies may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

1. Flange: AWWA C 207, Class D, ANSI 150 pound drilling.
2. Gasket: Affixed around recess of tap opening to prevent rolling or binding during installation.
3. Steel sleeves are restricted to use on pipe sizes 6 inches and larger.
4. Body: Heavy, welded-steel construction; top half grooved to retain neoprene O-ring seal permanently against outside diameter of pipe.
5. Bolts: AWWA C 500 Section 3.5; coated with 100 percent vinyl resin or corrosive resistant material.
6. Steel Sleeves Finish: Fusion-bonded epoxy coated to minimum 12 mil thickness.
7. Finished Epoxy Coat: Free of laminations and blisters; and remain pliant and resistant to impact with non-peel finish.
8. Provide approved steel tapping sleeves.
9. Tapping Sleeves: Provide with 3/4-inch NPT test opening for testing prior to tapping. Provide 3/4-inch bronze plug for opening.
10. Do not use steel sleeves for taps greater than 75 percent of pipe diameter.

C. Stainless Steel tapping-sleeve bodies and flange may be used in lieu of cast or ductile iron bodies for following sizes and with following restrictions:

1. Flange: ASTM A240 Stainless Steel, Type 304, ANSI 150 pound drilling.
2. Gasket: Full circumferential, affixed around recess of tap opening to prevent rolling or binding during installation, compounded for water and sewer service.
3. Stainless Steel sleeves are restricted to use on pipe sizes 4 inches and larger.
4. Body: ASTM A240 Stainless Steel, Type 304.
5. Bolts: ASTM A193 Stainless Steel, Type 304.
6. Nuts: ASTM A194 Stainless Steel, Type 304.
7. Branch Outlet: Heavy Stainless Steel Pipe.
8. Provide approved stainless steel tapping sleeves.
9. Do not use stainless steel sleeves for taps greater than 75 percent of pipe diameter.

D. Tapping Valves: Meet requirements of Division 33 with following exceptions:

1. Inlet Flanges:
   a. AWWA C 110; Class 125.
   b. AWWA C 110; Class 150 and higher: Minimum 8-hole flange.
2. Outlet: Standard mechanical or push-on joint to fit any standard tapping machine.

3. Valve Seat Opening: Accommodate full-size shell cutter for nominal size tap without contact with valve body; double disc.

E. Valve Boxes: Standard Type "A" valve boxes conforming to requirements of Division 33.

PART 3 E X E C U T I O N

3.1 APPLICATION

A. Install tapping sleeves and valves at locations and of sizes shown on Drawings. Install sleeve so valve is in horizontally level position unless otherwise indicated on Drawings.

B. Clean tapping sleeve, tapping valve, and pipe prior to installation and in accordance with manufacturer's instructions.

C. Hydrostatically test installed tapping sleeve to 150 psig for minimum of 15 minutes. Inspect sleeve for leaks, and remedy leaks prior to tapping operation.

D. When tapping concrete pressure pipe, size on size, use shell cutter one standard size smaller than water line being tapped.

E. Do not use Large End Bell (LEB) increasers with next size tap unless existing pipe is asbestos-cement.

3.2 INSTALLATION

A. Verify outside diameter of pipe to be tapped prior to ordering sleeve.

B. Tighten bolts in proper sequence so that undue stress is not placed on pipe.

C. Align tapping valve properly and attach to tapping sleeve. Insert insulation sleeves into flange holes of tapping valve and pipe. Make insertions of sleeves on pipe side of tapping valve. Do not damage insulation sleeves during bolt tightening process.

D. Make tap with sharp, shell cutter:
1. For 12-inch and smaller tap, use minimum cutter diameter one-half inch less than nominal tap size.
2. For 16-inch and larger tap, use manufacturer's recommended cutter diameter.

E. Withdraw coupon and flush cuttings from newly-made tap.

F. Wrap:
1. For 12-inch and smaller tap, wrap completed tapping sleeve and valve in accordance with Division 2.
2. For 16-inch and larger tap, apply coal tar epoxy around completed tapping sleeve and valve. The coal tar epoxy shall be applied with minimum of two (2) coats. Each coat of coal tar epoxy shall have minimum dry film thickness of 16 mils.

G. Place concrete thrust block behind tapping sleeve (not over tapping sleeve and valve).

H. Request inspection of installation prior to backfilling.

I. Backfill in accordance with Division 31.

END OF SECTION 33 12 13.10

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SECTION 33 12 13.12
WET CONNECTIONS

PART 1 G E N E R A L

1.01 SECTION INCLUDES

A. Wet connections for new water mains and service lines to existing water mains.

1.02 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment for wet connections shown on Drawings is on the basis of each wet connection. Separate payment will be made for each size of water main.
2. No compensation will be given for extra work or for damages occurring as a result of an incomplete shutoff.

B. 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.

1.03 REFERENCES

A. AWWA C 800 - Underground Service Line Valves and Fittings.

1.04 DEFINITIONS

A. Wet connections consist of isolating sections of pipe to be connected with installed valves, draining the isolated sections, and completing the connections.

B. Connection of 2-inch or smaller lines, which may be referred to on Drawings as "2-inch standard connections" or "gooseneck connections" will be measured as 2-inch wet connections. This item is not to be used as part of a 2-inch service line.

PART 2 P R O D U C T S

2.01 MATERIALS

A. Pipe shall conform to requirements of applicable portions of Division 33 related to piping materials and to water distribution.

B. Corporation cocks and saddles shall conform to requirements in Division 33.

C. Valves shall conform to requirements of Section 33 12 16 – Water Utility Distribution Valves.

D. Brass fittings shall conform to requirements of AWWA C 800.

PART 3 E X E C U T I O N

3.01 CONNECTION OPERATIONS

A. Plan wet connections in such manner and at such hours as to least inconvenience public. Notify Engineer at least 48 hours in advance of making connections.

B. Do not operate valves on mains in use by Owner. Owner Representative will handle, at no cost to Contractor, operations involving opening and closing valves for wet connections.

C. Conduct connection operations when Owner Representative is at job site. Connection work shall progress without interruption until complete once existing mains have been cut or plugs has been removed for making connections.

3.02 2-INCH WET CONNECTIONS

A. Tap water main. Use corporation cocks, saddles, copper tubing as required for line and grade adjustment, and brass fittings necessary to adapt to existing main. Use 2-inch valves when indicated on Drawings for 2-inch copper gooseneck connections.

END OF SECTION 33 12 13.12

SECTION 33 12 16
WATER UTILITY DISTRIBUTION VALVES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Gate valves.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for gate valves 20 inches in diameter and smaller under this Section. Include payment in unit price for water lines.
2. Payment for gate valves 24 inches to 36 inches in diameter is on a unit price basis. Unit price includes cost of required box for gate valves.
3. Payment for 2-inch blow-off valve with box is on a unit price basis for each installation.
4. Refer to Division 1 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 307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

B. ASTM B 62 - Standard Specification for Composition Bronze or Ounce Metal Casting.

C. ASTM D 429 - Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.

D. ASTM B 763 - Standard Specification for Copper Alloy Sand Casting for Valve Application.

E. AWWA C 500 - Standard for Metal-Seated Gate Valves for Water Supply Service.

F. AWWA C 509 - Standard for Resilient-Seated Gate Valves for Water Supply Service.

G. AWWA C 515- Standard for Reduced Wall, Resilient- Seated Gate Valves for Water Supply Service.

H. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's product data for proposed valves for approval.

C. Provide detailed drawings of gearing mechanism for 20-inch and larger gate valves.

1.5 QUALITY CONTROL

A. Submit manufacturer's affidavit that gate valves are manufactured in the United States and conform to stated requirements of AWWA C 500, AWWA C 509, AWWA C 515, and this Section, and that they have been satisfactorily tested in the United States in accordance with AWWA C 500, AWWA C 509, and AWWA C 515.

PART 2 P R O D U C T S

2.1 MATERIALS

A. Gate Valves: AWWA C 500, AWWA C 509, AWWA C 515 and additional requirements of this Section. Direct bury valves and those in subsurface vaults open clockwise; aboveground and plant valves open counterclockwise.

B. If type of valve is not indicated on Drawings, use gate valves as line valves for sizes 20-inches and smaller. When type of valve is indicated, no substitute is allowed.

C. Gate Valves 1-1/2 inches in Diameter and Smaller: 125 psig; bronze; rising-stem; single-wedge; disc type; screwed ends.

D. Coatings for Gate Valves 2 inches and larger: AWWA C 550 non-toxic, imparts no taste to water, functions as physical, chemical, and electrical barrier between base metal and surroundings, minimum 8-mil-thick, fusion-bonded epoxy. Prior to assembly of valve, apply protective coating to interior and exterior surfaces of body.

E. Gate Valves 2 inches in diameter: Iron body, double disc or resilient-seated, non-rising stem, 150-pound test, 2-inch square nut operating clockwise to open.

F. Gate Valves 3 inches to 12 inches in diameter: Non-directional, standard-wall resilient seated (AWWA C 509), parallel seat double disc (AWWA C 500), or reduced-wall resilient seated gate valves (AWWA C 515), 200 psig pressure rating, bronze mounting, push-on bell ends with rubber joint rings, and nut-operated unless otherwise specified. Provide approved standard-wall resilient seated valves. Provide approved reduced-wall resilient seated valves. Provide approved double disc valves. Comply with following requirements unless otherwise specified in Drawings:

1. Design: Fully encapsulated rubber wedge or rubber seat ring mechanically attached with minimum 304 stainless-steel fasteners or screws; threaded connection isolated from water by compressed rubber around opening.
2. Body: Cast or ductile iron, flange bonnet and stuffing box together with ASTM A 307 Grade B bolts. Manufacturer's initials, pressure rating, and year manufactured shall be cast in body.
3. Bronze: Valve components in waterway to contain not more than 15 percent zinc and not more than 2 percent aluminum.
4. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
5. O-rings: For AWWA C 500, Section 3.12.2. For AWWA C 509, Sections 2.2.6 and 4.8.2. For AWWA C 515, Section 4.2.2.5.
6. Stem Seals Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.

G. Stem Nut: Independent or integrally cast of ASTM B 62 bronze.

H. Resilient Wedge: Molded, synthetic rubber, vulcanized and bonded to cast or ductile iron wedge or attached with 304 stainless steel screws tested to meet or exceed ASTM D 429 Method B; seat against epoxy-coated surface in valve body.

I. Bolts: AWWA C 500 Section 3.4, AWWA C 509 Section 4.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.

J. Gate valves 14 inch and larger in Diameter: AWWA C 500; parallel seat double disc gate valves; push-on bell ends with rubber rings and nut-operated unless otherwise specified. Provide approved double disc valves with 150 psig pressure rating. Comply with following requirements unless otherwise specified on Drawings:

1. Body: Cast iron or ductile iron; flange together bonnet and stuffing box with ASTM A 307 Grade B bolts. Cast following into valve body manufacturer's initials, pressure rating, and year manufactured. When horizontally mounted, equip valves greater in diameter than 12 inches with rollers, tracks, and scrapers.
2. O rings: For AWWA C 500, Section 3.12.2. For AWWA C 515, Section 4.2.2.5.
3. Stems: ASTM B 763 bronze, alloy number-995 minimum yield strength of 40,000 psi; minimum elongation in 2-inches of 12 percent, non-rising.
4. Stem Nut: Machined from ASTM B 62 bronze rod with integral forged thrust collar machined to size; non-rising.
5. Stem Seals: Consist of three O-rings, two above and one below thrust collar with anti-friction washer located above thrust collar for operating torque.
6. Bolts: AWWA C 500 Section 3.4 or AWWA C 515 Section 4.4.4; stainless steel; cadmium plated, or zinc coated.
7. Discs: Cast iron with bronze disc rings securely penned into machined dovetailed grooves.
8. Wedging Device: Solid bronze or cast-iron, bronze-mounted wedges. Thin plates or shapes integrally cast into cast-iron surfaces are acceptable. Other moving surfaces integral to wedging action shall be bronze monel or nickel alloy-to-iron.
9. Provide bypass for valves 24 inches and larger.
10. Bronze Mounting: Built as integral unit mounted over, or supported on, cast-iron base and of sufficient dimensions to be structurally sound and adequate for imposed forces.
11. Gear Cases: Cast iron; furnished on 18-inch and larger valves and of extended type with steel side plates, lubricated, gear case enclosed with oil seal or O-rings at shaft openings.
12. Stuffing Boxes: Located on top of bonnet and outside gear case.

K. Gate valves 14 inches to 24 inches: Provide AWWA C 515; reduced-wall, resilient seated gate valves with 250 psig pressure rating. Furnish with spur or bevel gearing.

1. Mount valves horizontally if proper ground clearance cannot be achieved by normal vertical installation. For horizontally mounted gate valves, provide bevel operation gear mounted vertically for above ground operation.
2. Use valve body, bonnet, wedge, and operator nut constructed of ductile iron. Fully encapsulate exterior of ductile iron wedge with rubber.
3. Ensure wedge is symmetrical and seals equally well with flow in either direction.
4. Provide ductile iron operator nut with four flats at stem connection to apply even input torque to the stem.
5. Bolts: AWWA C515, Section 4.4.4, Stainless Steel; cadmium plated or zinc coated.
6. Provide high strength bronze stem and nut.
7. O-rings: AWWA C515, Section 4.2.2.5, pressure O-rings as gaskets.
8. Provide stem sealed by three O-rings. Top two O-rings are to be replaceable with valve fully open at full rated working pressure.
9. Provide thrust washers to the thrust collar for easy valve operation.

L. Gate Valves Extension Stem: When shown on Drawings, provide non-rising, extension stem having coupling sufficient to attach securely to operating nut of valve. Upper end of extension stem shall terminate in square wrench nut no deeper than 4 feet from finished grade or as shown on Drawings. Support extension stem with an arm attached to wall of manhole or structure that loosely holds extension stem and allows rotation in the axial direction only.

M. Gate Valves in Factory Mutual (Fire Service) Type Meter Installations: Conform to provisions of this specification; outside screw and yoke valves; carry label of Underwriters' Laboratories, Inc.; flanged, Class 125; clockwise to close.

N. Gate Valves for Tapping Steel Pipe: Provide double disc gate valve. Resilient wedge gate valve shall only be installed in a vertical position.

O. Provide flanged joints when valve is connected to steel or PCCP.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Earthwork. Conform to applicable provisions of Division 31.

B. Operation. Do not use valves for throttling without prior approval of manufacturer.

3.2 SETTING VALVES AND VALVE BOXES

A. Remove foreign matter from within valves prior to installation. Inspect valves in open and closed positions to verify that parts are in satisfactory working condition.

B. Install valves and valve boxes where shown on Drawings. Set valves plumb and as detailed. Center valve boxes on valves. Carefully tamp earth around each valve box for minimum radius of 4 feet, or to undisturbed trench face when less than 4 feet. Install valves completely closed when placed in water line.

C. For pipe section of each riser, use only 6 inch, ductile iron Class 51, or DR18 PVC pipe cut to proper length. Riser must be installed to allow complete access for operation of valve.

D. Assemble and brace box in vertical position as indicated on Drawings.

3.3 DISINFECTION AND TESTING

A. Assist Owner’s Representative with disinfection of valves and appurtenances as required by Division 33 and test as required by Division 33.

B. Double-Disc Gate Valves: Apply hydrostatic test pressure equal to twice rated working pressure of valve between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied between discs. Valve shall show no leakage through metal, flanged joints, or stem seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

C. Solid-Wedge Gate Valves: Apply hydrostatic pressure equal to twice rated working pressure of valve with both ends bulkheaded and gate open. Valve shall show no leakage through metal, flanged joints, or stem seals. Test at rated working pressure, applied through bulkheads alternately to each side of closed gate with opposite side open for inspection. Valve shall show no leakage through metal, flanged joints, or stem-seals. Do not exceed leakage rate of 1 oz/hr/inch of nominal valve size.

D. Repair or replace valves which exceed leakage rate.

END OF SECTION 33 12 16

SECTION 33 12 19
WATER UTILITY DISTRIBUTION FIRE HYDRANTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Fire hydrants.

B. Adjustment of fire hydrants and gate valves.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. Payment is on a unit price basis for each fire hydrant assembly, including 6-inch gate valve and box, installed regardless of barrel depth.
2. Payment for fire hydrant branches (leads) is on linear foot basis for each branch installed. Separate pay items are used for open-cut and augered branches.
3. Payment for salvaged fire hydrants is on unit price basis for each fire hydrant removed and returned to Owner's Maintenance Quadrant Stock yard.
4. Refer to Division 1 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. AWWA C 550 - Standard for Protective Epoxy Interior Coatings for Valves and Hydrants

B. SSPC SP2 - Hand Tool Cleaning

C. SSPC SP3 - Power Tool Cleaning

D. SSPC SP10 - Near-White Blast Cleaning

E. SSPC SP11 - Power Tool Cleaning to Bare Metal

F. SSPC Paint Spec No.21

G. SSPC-Paint 21 - White or Colored Silicone Alkyd Paint

H. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II

I. SSPC-Paint 104 - White or Tinted Alkyd Paint

J. Federal Standard A-A-2962A - Enamel, Alkyd, Solvent Based Low VOC

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit name of hydrant manufacturer, type of bonnet paint, and engineering control drawing number for hydrant proposed for use.

PART 2 P R O D U C T S

2.1 HYDRANTS

A. Provide approved fire hydrants.

B. The Owner's Representative may, at any time prior to or during installation of hydrants, randomly select furnished hydrant for disassembly and laboratory inspection, at Owner's expense, to verify compliance with Specifications. When hydrant is found to be non-compliant, replace, at Contractor's expense, hydrants, with hydrants that comply with Specifications.

C. Provide lower hydrant barrel fabricated from Ductile Iron Pipe as single piece, connected to upper hydrant barrel by means of joint coupling that will provide three hundred sixty degree (360) rotation of upper barrel.

2.2 LEADS

A. Branches (Leads): Conform to requirements of Division 33.

2.3 HYDRANT PAINTING

A. New hydrants and refurbished hydrants shall be shop coated as specified herein.

B. Exterior Above Traffic Flange (Including Bolts & Nuts).

1. Surface preparation to be in accordance with SSPC-SP 10 (MACE 2) near white blast cleaned surface.
2. Coat with three coat alkyd/silicone alkyd system with total dry film thickness (DFT) of 6 - 9 mils as follows:
   a. Prime Coat - Oil modified alkyd primer, to be in general conformance with SSPC Paint Specification No. 25. Total dry film thickness (DFT) 2 - 3 mils.
   b. Intermediate Coat - Heavy Duty Industrial Alkyd Enamel to be in general conformance with SSPC Paint Specification No. 104, and Federal Standard A-A-2962A. Total dry film thickness (DFT) of 2 -3 mils.
   c. Finish Coat - Silicone Alkyd Resin Enamelto be in general conformance with SSPC Paint Specification No. 21. Total dry film thickness (DFT) to be 2 - 3 mils. Exception – hydrant bonnet shall not be finished shop coated, only intermediate coated. Install color coded finish coating of bonnet in field.
   d. Bonnet Paint - Field apply finish coat of Silicone Alkyd Resin Enamel to be in general conformance with SSPC Paint Specification No. 21. Dry film thickness of 2 - 3 mils. Bonnet colors are to be as specified in Paragraph 3.01 to designate the appropriate size of water supply line.
3. Colors - Primer: Manufacturers standard color. Finish coat of hydrant body : As specified by Owner . Connection caps: Finished coated white. Paint white band of finish coat two (2) inches in width on hydrant body approximately six inches (6") above and parallel to traffic flange. Intermediate coat: Contrasting color to blue finish, such as white.

C. Field Maintenance Painting (Exterior Above Traffic Flange)

1. Surface Preparation to be in accordance with SSPC - SP2, Hand Tool Cleaning, or SSPC -SP3, Power Tool Cleaning, depending on condition of existing paint and extent of corrosion. It is not necessary to remove tightly adhered mill scale, rust, and paint.

Mill scale, rust and paint are considered tightly adherent when they cannot be removed with dull putty knife. In some severe cases where it is necessary to remove majority of existing paint, surface should be cleaned in accordance with SSPC -SP11, Power Tool Cleaning to Bare Metal.

2. When surface is cleaned to bare metal (SSPC - SP11), coat hydrant with three coat Alkyd/Silicone Alkyd system in accordance with Paragraph 2.03.B.2 as for new hydrants. When surface is cleaned to SSPC - SP2 or SSPC - SP3, coat hydrant with Silicone Alkyd Resin Enamelin general conformance with SSPC Paint Specification No. 21. Total dry film thickness of 3 - 6 mils.

D. Exterior Below Traffic Flange

1. Surface preparation in accordance with SSPC- SP10 (MACE 2) Near White Blast Cleaned Surface.
2. Primer and intermediate coat: coal tar epoxy in general conformance with SSPC Paint Specification No. 16. Apply two (2) coats with dry film thickness (DFT) of 8 - 10 mils each for total DFT of 16 -20 mils.
3. Finish coat: Water based vinyl acrylic mastic Apply one coat with dry film thickness of 6 - 8 mils. Color of finish coat to be same as finish coat for exterior above traffic flange, i.e., blue. (Acro 555 Crystal Blue, or equivalent.)

E. Interior Surfaces Above and Below Water Line Valve

1. Material used for internal coating of hydrant interior ferrous surfaces below water line valve must be NSF certified as suitable for contact with potable water as required by Chapter 290, Rules and Regulations for Public Water Systems, Texas Natural Resources Conservation Commission.
2. Coating shall be liquid or powder epoxy system in accordance with AWWA Standard C - 550 (latest revision). Coating may be applied in two or three coats, according to manufacturer's recommendations, for total dry film thickness of 12 -18 mils.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Set fire hydrant plumb and brace at locations and grades as shown on Drawings. When barrel of hydrant passes through concrete slab, place 1-inch-thick piece of standard sidewalk expansion joint material around section of barrel passing through concrete.

B. Locate nozzle center line minimum 18 inches above finish grade.

C. Place 12-inch by 12-inch yellow indicators (plastic, sheet metal, plywood, or other material approved by Owner’s Representative) on pumper nozzles of new or relocated fire hydrants installed on new water lines not in service. Remove indicators after new water line is tested and approved by Owner’s Representative.

D. Do not cover drain ports when placing concrete thrust block.

E. Obtain Owner’s Representative’s approval in writing prior to installation of hydrants which require changes in bury depth due to obstructions not shown on Drawings. Unit price adjustments will not be allowed for changes in water line flow line or fire hydrant barrel length caused by obstructions.

F. Plug branch lines to valves and fire hydrants shown on Drawings to be removed. Deliver fire hydrants designated for salvage to nearest Utility Maintenance Quadrant Facility.

G. Install branches (leads) in accordance with Division 33.

H. Coating Requirements:

1. Apply coatings in strict accordance with manufacturer's recommendations. No requirements of this specification shall cancel or supersede written directions and recommendations of specific manufacturer so as to jeopardize integrity of applied system.
2. Furnish affidavit of compliance that coatings furnished complies with requirements of this specification and referenced standards, as applicable.

I. Field coat hydrant bonnet to indicate size of water line supplying hydrant or tested flow at the fire hydrant as directed by the Fire Marshall or Owner.

J. Remove and dispose of unsuitable materials and debris in accordance with requirements of Division 1.

END OF SECTION 33 12 19

SECTION 33 12 40
VALVE BOXES, METER BOXES, AND METER VAULTS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Valve boxes for water service.

B. Meter boxes for water service.

C. Meter vaults for water service.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for valve boxes under this Section. Include payment in unit price for Division 1.
2. No separate payment will be made for meter boxes under this Section. Include payment in unit price for Division 1.
3. Payment for each size of meter vaults is on unit price basis per vault. Payment will be made for each vault installed, regardless of depth.
4. Refer to Division 1.

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 48 - Standard Specification for Gray Iron Castings.

B. ASTM D 256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.

C. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.

D. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.

E. ASTM D 790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

F. ASTM D 2240 - Standard Test Method for Rubber Property-Durometer Hardness.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturers' product data for following items for approval:

1. Each type of valve box and lid.
2. Each type of meter box and cover.
3. Each type of meter vault frame and cover.

C. Submit design calculations and shop drawings for precast vault elements, sealed by an Engineer registered in State of Texas.

D. Submit shop drawings for cast-in-place meter vaults for approval if proposed construction varies from Drawings.

E. Submit manufacturer's certification that plastic meter boxes meet requirements of Paragraph 2.05, Plastic Meter Boxes.

PART 2 P R O D U C T S

2.1 VALVE BOXES

A. Provide approved Type A, cast-iron/ductile-iron, slide-type, valve boxes. Design of valve box shall minimize stresses on valve imposed by loads on box lid.

B. Cast letter “W” into lid, 1/2 inch in height and raised 3/32 inch, for valves serving potable water lines.

C. Unless otherwise specified, uncoated cast iron.

D. Riser Pipe.

1. Provide 6-inch PVC, Class 150, DR 18, riser pipes in accordance with Division 33 or
2. 6-inch ductile-iron, thickness Class 51 riser pipes in accordance with Division 33.
3. Provide single section of pipe.

E. Concrete for valve box placement:

1. For locations in new concrete pavement, provide strength and mix design of new pavement.
2. For other locations, provide concrete for sidewalks conforming to requirements of Division 32.

2.2 METER BOXES

A. Provide meter boxes as required by the governing authority and as shown on the drawings.

2.3 CAST-IRON METER BOXES

A. Cast-Iron Boxes: Clean and free from sand blow-holes or other defects conforming to requirements of ASTM A 48, Class 30B. Bearing surfaces shall be machined so that covers seat evenly in frames.

B. Boxes and lids shall have dipped, coal-tar-pitch, varnish finish.

C. Provide lock-type meter boxes when required by Drawings. Lock mechanisms shall work with ease.

2.4 CONCRETE METER BOXES

A. Concrete Meter Boxes: Made of Class A concrete, with minimum 4000 psi compressive strength, conforming to requirements of Division 32. Construct to dimensions shown on Drawings.

B. Castings: Free from fractures, large or deep cracks, blisters or surface roughness or any other defects that may affect serviceability.

2.5 PLASTIC METER BOXES

A. Plastic Meter Boxes: Made of high density polyethylene conforming to the following ASTM standards:

ASTM	REQUIREMENT
D 256	Impact Strength = 1/9 ft.-lb./inch (Izod, Notched)
D 256	Impact Strength – 6.4 ft.-lb./inch (Izod, Un-Notched)
D 638	Tensile Strength (2.0 min.) = 3400 psi
D 648	Deflection Temperature = 170 degrees F
D 2240	Shore D, Hardness, 55-65 Impact Strength, Falling Dart Method, 160 inch-lb.
D 790	Flexural Modulus = 90,000 psi

B. Meter boxes shall meet the following test requirements:

1. Static Load: Not less than 2500 pounds using 6-inch disc with direct compression exerted at center of top of meter box with solid plastic lid.
2. Deflection: Not less than 1000 pounds load required to deflect top edge of meter box 1/8- inch.
3. Meter box body, without lid, shall weigh approximately 7 pounds.

2.6 METER VAULTS

A. Meter vaults may be constructed of precast concrete, cast-in-place concrete, or common brick masonry unless a specific type of construction is required by Drawings.

B. Concrete for Meter Vaults: Class A concrete, conforming to requirements of Division 32 with minimum compressive strength of 4000 psi at 28 days.

C. Reinforcing steel for meter vaults: Conform to requirements of Division 32.

D. Grates and Covers: Conform to requirements of Division 33.

PART 3 E X E C U T I O N

3.1 EXAMINATION

A. Obtain approval from Owner’s Representative for location of meter vault.

B. Verify lines and grade are correct.

C. Verify compacted subgrade will support loads imposed by vaults.

3.2 VALVE BOXES

A. Install riser pipe with suitable length for depth of cover indicated on Drawings or to accommodate actual finish grade.

1. Install with bell on top of valve.
2. Place riser pipe in plumb, vertical position.

B. Install valve box and riser piping plumbed in a vertical position. Provide 6-inches telescoping freeboard space between riser pipe top butt end, and interior contact flange of valve box, for vertical movement damping. End of pipe resting on valve shall be notched out sufficiently to provide a snug fit around the valve bonnet and to center valve inside of pipe.

C. Set, align, and adjust valve box so that lid is level with final grade.

D. Paint covers of new valve boxes in fluorescent orange when installed. After completion and acceptance by Owner, repaint covers black.

3.3 METER BOXES

A. Install cast iron or plastic boxes in accordance with manufacturer's instructions.

B. Construct concrete meter boxes to dimensions shown on Drawings.

C. Adjust top of meter boxes to conform to cover elevations specified in Paragraph 3.05, Frame and Cover for Meter Vaults.

D. Do not locate under paved areas unless approved by Owner's Representative. Use approved traffic-type box with cast iron lid when meter must be located in paved areas.

3.4 METER VAULTS

A. Construct concrete meter vaults to dimensions shown on Drawings. Do not cast in presence of water. Make bottom uniform. Verify lines and grades are correct and compacted subgrade will support loads imposed by vaults.

B. Precast Meter Vaults:

1. Install precast vaults in accordance with manufacturer's recommendations. Set level on a minimum 3-inch-thick bed of sand conforming to requirements of Division 31.
2. Seal lifting holes with cement-sand mortar or non-shrink grout.

C. Meter Vault Floor Slab:

1. Construct floor slabs of 6-inch-thick reinforced concrete. Slope floor 1/4 inch per foot toward sump. Make sump 12 inches in diameter, or 12 inches square, and 4 inches deep, unless other dimensions are required by Drawings. Install dowels at maximum of 18 inches, center-to-center for keying walls to floor slab.

2. Precast floor slab elements may be used for precast vault construction.

D. Cast-in-Place Meter Vault Walls:

1. Key walls to floor slab and form to dimensions shown on Drawings. Minimum wall thickness shall be 4 inches.
2. Cast walls monolithically. One cold joint will be allowed when vault depth exceeds 12 feet.
3. Set frame for cover in concrete.

3.5 FRAME AND COVER FOR METER VAULTS

A. Set cast iron frame in a mortar bed and adjust elevation of cover as follows:

1. In unpaved areas, set top of meter box or meter vault cover 2 to 3 inches above natural grade.
2. In paved areas, set top of meter box or meter vault cover flush with adjacent concrete but no higher than 1/2-inch.

3.6 BACKFILL

A. Provide bank run sand in accordance with Division 31 and backfill and compact in accordance with Division 31.

B. In unpaved areas, slope backfill around meter boxes and vaults to provide a uniform slope 1-to-5 slope from top to natural grade.

C. In paved areas, slope concrete down from meter box or vault to meet adjacent paved area.

END OF SECTION 33 12 40

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SECTION 33 13 00
DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Disinfection of potable water lines.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No separate payment will be made for disinfection of water lines under this Section. Include cost in unit price of water lines being disinfected.
2. Refer to Division 1 for unit price procedures.

B. Adjusting Payment for Retesting.

1. Subsequent disinfection operations which may be necessary due to nonconforming or incomplete construction will be charged to Contractor. Charges will be deducted from retainage amounts when construction estimates are processed for final payment.
2. Total charge will consist of base charge of $135.00 plus footage charge based on number of feet of specified diameter pipe in construction project. Footage charge is as follows:

Size of Pipe	Charge per Linear Foot
2 inch to 4 inch	$0.03
6 inch	$0.04
8 inch	$0.05
10 inch to 12 inch	$0.07
16 inch to 20 inch	$0.09
24 inch to 30 inch	$0.13
32 inch to 48 inch	$0.16
54 inch	$0.20
60 inch	$0.22
66 inch	$0.31
72 inch to 84 inch	$0.40
90 inch to 96 inch	$0.58
108 inch	$0.75
120 inch or larger	$1.00

C. 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. AWWA C 651 - Standard for Disinfecting Water Mains.

PART 2 P R O D U C T S -Not Used

PART 3 E X E C U T I O N

3.1 CONDUCTING DISINFECTION

A. Promptly disinfect water lines constructed before tests are conducted on water lines and before water lines are connected to Public water distribution system.

B. Contractor shall provide water for disinfection at no additional charge to the Owner.

C. Unless otherwise provided in Contract Documents, Contractor will conduct disinfection operations.

D. Coordinate chlorination operations through Owner's Representative.

3.2 PREPARATION

A. Provide temporary blind flanges, cast-iron sleeves, plugs, necessary service taps, copper service leads, risers and jumpers of sizes, location and materials, and other items needed to facilitate disinfection of new water lines prior to connection to Public water distribution system. Normally, each valved section of water line requires two each 3/4-inch taps. A 2-inch minimum blow-off is required for water lines up to and including 6-inch diameter.

B. Use fire hydrants as blow-offs to flush newly constructed water lines 8 inch diameters and above. Where fire hydrants are not available on water lines, install temporary blow-off valves and remove promptly upon successful completion of disinfection and testing.

C. Slowly fill each section of pipe with water in manner approved by Owner's Representative. Average water velocity when filling pipeline should be less than one foot per second and shall not, under any circumstance, exceed 2 feet per second. Before beginning disinfection operations, expel air from pipeline.

D. Backfill excavations immediately after installation of risers or blow-offs.

E. Install blow-off valves at end of water line to facilitate flushing of dead-end water lines. Install permanent blow-off valves according to drawings.

3.3 DISINFECTION BY CONTRACTOR

A. The following procedure will be used when disinfection by Contractor is required by Contract Documents:

1. Use not less than 100 parts of chlorine per million parts of water.
2. Introduce chlorinating material to water lines in accordance with AWWA C 651.
3. After contact period of not less than 24 hours, flush system with clean water until residual chlorine is no greater than 1.0 parts per million parts of water.
4. Open and close valves in lines being sterilized several times during contact period.
5. If chemical compound is used for sterilizing agent, place in pipes as directed by Owner's Representative.

3.4 BACTERIOLOGICAL TESTING

A. After disinfection and flushing of water lines, bacteriological tests will be performed by the governing agency or testing laboratory in accordance with Division 1. When test results indicate need for additional disinfection of water lines based upon Texas Department of

Health requirements, assist Contractor shall provide additional disinfection operations at no additional cost to the Owner.

3.5 COMPLETION

A. Upon completion of disinfection and testing, remove risers except those approved for use in subsequent hydrostatic testing, and backfill excavation promptly.

END OF SECTION 33 13 00

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SECTION 33 13 00.10
HYDROSTATIC TESTING OF PIPELINES

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Field hydrostatic testing of newly installed water pipelines.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.
   1. No payment will be made for hydrostatic testing of pipelines under this Section. Include cost in unit price of pipelines being tested.
   2. Refer to Division 1 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.

PART 2 P R O D U C T S – Not Used

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Disinfect water system pipelines prior to hydrostatic testing.

B. Hydrostatically test newly installed water pipelines after disinfection, when required, and before connecting to Public water distribution system.

C. Water for testing will be charged to Contractor in accordance with applicable Ordinances. Prior to hydrostatic testing, obtain a transient meter from the appropriate governing authority. Contractor shall pay all fees associated with transient meter.

D. Test pipelines in lengths between valves, or plugs, of not more than 4,000 feet.

E. Conduct hydrostatic tests in presence of Owner’s Representative.

3.2 TEST PROCEDURES

A. Furnish, install, and operate connections, pump, meter and gages necessary for hydrostatic testing.

B. Allow pipeline to sit minimum of 24 hours from time it is initially disinfected until testing begins, to allow pipe wall or lining material to absorb water. Periods of up to 7 days may be required for mortar lining to become saturated.

C. For small diameter pipelines, expel air and apply minimum test pressure of 125 psi. For large diameter water lines, expel air and apply minimum test pressure of 150 psi.

D. Begin test by 9:00 a.m. unless otherwise approved by Owner’s Representative. Maintain test pressure for 8 hours. When large quantity of water is required to maintain pressure during test, discontinue testing until cause of water loss is identified and corrected.

E. Keep valves inside pressure reducing stations closed during hydrostatic pressure test.

3.3 ALLOWABLE LEAKAGE FOR WATERLINES

A. During hydrostatic tests, no leakage will be allowed for sections of water lines consisting of welded joints.

B. Maximum allowable leakage for water lines with rubber gasketed joints: 3.19 gallons per inch nominal diameter per mile of pipe per 24 hours while testing.

C. For meter run installation, when work cannot be isolated and line fails pressure test, visual inspection of work by Owner's Representative for leakage during pressure test may be used to fulfill requirements of this section.

3.4 CORRECTION FOR FAILED TESTS

A. Repair joints showing visible leaks on surface regardless of total leakage shown on test. Check valves and fittings to ensure that no leakage occurs that could affect or invalidate test. Remove cracked or defective pipes, fittings, and valves discovered during pressure test and replace with new items.

B. Owner's Representative may require failed lines to be disinfected after repair and prior to retesting. Conduct and pay for subsequent disinfection operations in accordance with requirements of Division 33. Pay for water required for additional disinfection and retesting.

C. Repeat test until satisfactory results are obtained.

3.5 COMPLETION

A. Upon satisfactory completion of testing, remove risers remaining from disinfection and hydrostatic testing, and backfill excavation promptly.

END OF SECTION 33 13 00.10

SECTION 33 31 00
SANITARY UTILITY SEWERAGE PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Gravity sanitary sewers and appurtenances, including stacks and service connections.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for gravity sanitary sewers by open-cut or within Potentially Petroleum Contaminated Area (PPCA) is on linear foot basis, complete in place, including sewer pipe, connections to existing manholes, post installation television inspection and testing. Measurement will be taken along centerline of pipe from centerline to centerline of manholes.
2. Payment for television inspection of existing gravity sanitary sewer will be on a linear foot basis. Measurement will be taken along centerline of pipe from centerline to centerline of manholes. See Division 1.
3. Refer to Division 1 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 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

C. Test Reports: Submit test reports and inspection videos as specified in Part 3 of this Section. Video tapes become property of Owner.

1.4 QUALITY ASSURANCE

A. Qualifications. Install sanitary sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections. Perform testing in accordance with Division 33.

B. Regulatory Requirements.

1. Install sewer lines to meet minimum separation distance from potable water line, as scheduled below. Separation distance is defined as distance between outside of water pipe and outside of sewer pipe. When possible, install new sanitary sewers no closer to water lines than 9 feet in all directions. Where this separation distance cannot be achieved, new sanitary sewers shall be installed as specified in this section.
2. Make notification to Owner’s Representative when water lines are uncovered during sanitary sewer installation where minimum separation distance cannot be maintained.
3. Lay gravity sewer lines in straight alignment and grade.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Inspect pipe and fittings upon arrival of materials at job site.

B. Handle and store pipe materials and fittings to protect them from damage due to impact, shock, shear or free fall. Do not drag pipe and fittings along ground. Do not roll pipe unrestrained from delivery trucks.

C. Use mechanical means to move or handle pipe. Employ acceptable clamps, rope or slings around outside barrel of pipe and fittings. Do not use hooks, bars, or other devices in contact with interior surface of pipe to lift or move lined pipe.

PART 2 P R O D U C T S

2.1 PIPE

A. Provide piping materials for gravity sanitary sewers of sizes and types indicated on Drawings or as specified.

B. Reinforced concrete pipes are not acceptable.

2.2 PIPE MATERIAL SCHEDULE

A. Unless otherwise shown on Drawings, use pipe materials that conform to requirements specified in Division 33.

B. Where shown on Drawings, provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

C. Pipe materials other than those listed above shall not be used for gravity sanitary sewers.

2.3 APPURTENANCES

A. Stacks. Conform to the requirements of Division 33.

B. Service Connections. Conform to requirements of Division 33.

C. Roof, street or other type of surface water drains shall not be connected or reconnected into sanitary sewer lines.

2.4 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill: Conform to requirements of Division 31.

B. Topsoil: Conform to requirements of Division 32.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affect traffic. Conform to requirements of Division 1.

B. Provide barricades, flashing warning lights, and warning signs for excavations. Conform to requirements of Division 1. Maintain barricades and warning lights where work is in progress or where traffic is affected by work.

C. Perform work in accordance with OSHA standards. Employ trench safety system as specified in Division 31 for excavations over 5 feet deep.

D. Immediately notify agency or company owning utility line which is damaged, broken or disturbed. Obtain approval from Owner's Representative and agency or utility company for repairs or relocations, either temporary or permanent.

E. Remove old pavements and structures including sidewalks and driveways in accordance with requirements of Division 2.

F. Install and operate dewatering and surface water control measures in accordance with Division 1.

G. Do not allow sand, debris or runoff to enter sewer system.

3.2 DIVERSION PUMPING

A. Install and operate required bulkheads, plugs, piping, and diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. Obtain approval for diversion pumping equipment and procedures from Owner's Representative.

B. Design piping, joints and accessories to withstand twice maximum system pressure or 50 psi, whichever is greater.

C. No sewage shall be diverted into area outside of sanitary sewer.

D. In event of accidental spill or overflow, immediately stop overflow and take action to clean up and disinfect spillage. Promptly notify Owner's Representative so that required reporting can be made to Texas Natural Resources Conservation Commission and Environmental Protection Agency by Owner's Representative.

3.3 EXCAVATION

A. Earthwork. Conform to requirements of Division 31. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade in trench from benchmarks identified by Owner's Representative. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of work. Use of appropriately sized grade boards which are substantially supported is also acceptable. Protect boards and location stakes from damage or dislocation.

C. Trench Excavation. Excavate pipe trenches to depths shown on Drawings and as specified in Division 31.

3.4 PIPE INSTALLATION BY OPEN CUT

A. Install pipe in accordance with pipe manufacturer's recommendations and as specified in following paragraphs.

B. Install pipe only after excavation is completed, bottom of trench fine graded, bedding material is installed, and trench has been approved by Owner's Representative.

C. Install pipe to line and grade indicated. Place pipe so that it has continuous bearing of barrel on bedding material and is laid in trench so interior surfaces of pipe follow grades and alignment indicated. Provide bell holes where necessary.

D. Install pipe with spigot ends toward downstream end of flow such that water flows into bell and out the spigot.

E. Form concentric joint with each section of adjoining pipe so as to prevent offsets.

F. Keep interior of pipe clean as installation progresses. Remove foreign material and debris from pipe.

G. Provide lubricant, place and drive home newly laid sections with come-a-long winches so as to eliminate damage to sections. Install pipe to "home" mark where provided. Use of back hoes or similar powered equipment will not be allowed unless protective measures are provided and approved in advance by Owner’s Representative.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with approved plug to prevent foreign material from entering pipe.

J. Where gravity sanitary sewer is to be installed under existing water line with separation distance of at least 2 feet and less than 9 feet, install new sewer pipe so that one full18 foot long pipe is centered on water line crossing. Embed sewer pipe in cement stabilized sand for minimum distance of 9 feet on each side of crossing.

K. Where gravity sanitary sewer is to be installed under existing water line with separation distance of less than 2 feet, install new sewer using pressure-rated pipe as shown on Drawings. Maintain minimum 6-inch separation distance.

L. Where the length of the stub is not indicated, install the stub to the right-of-way line and seal the free end with an approved plug.

3.5 PIPE INSTALLATION OTHER THAN OPEN CUT

A. For installation of pipe by augering, jacking, or tunneling, conform to requirements of specification sections on tunneling augering, jacking and microtunneling work as appropriate.

3.6 INSTALLATION OF APPURTENANCES

A. Service Connections. Install service connections to conform to requirements of Division 33.

B. Stacks. Construct stacks to conform to requirements of Division 33.

C. Construct manholes to conform to requirements of Division 33 as applicable. Install frames, rings, and covers to conform to requirements of Division 33.

3.7 INSPECTION AND TESTING

A. Visual Inspection: Check pipe alignment in accordance with Division 33.

B. Mandrel Testing. Use Mandrel Test to test flexible pipe for deflection. Refer to Division 33.

C. Pipe Leakage Test. After backfilling line segment and prior to tie-in of service connections, visually inspect gravity sanitary sewers where feasible, and test for leakage in accordance with Division 33. Maintain piezometer installed to conform with Division 1until acceptance testing is completed.

3.8 BACKFILL AND SITE CLEANUP

A. Backfill and compact soil in accordance with Division 31.

B. Backfill trench in specified lifts only after pipe installation is approved by Owner's Representative.

C. Repair and replace removed or damaged pavement, curbs, gutters, and sidewalks as specified in Division 32.

D. Provide hydromulch seeding in areas of commercial, industrial or undeveloped land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and apply hydromulch according to requirements of Division 32.

E. Provide sodding in areas of residential land use over surface of ground disturbed during construction and not paved or not designated to be paved. Grade surface at uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and sod disturbed areas in accordance with Division 32.

3.9 POST-INSTALLATION TELEVISION INSPECTION

A. Prior to final acceptance of newly constructed gravity sanitary sewers, perform cleaning and video inspection. Cleaning shall include utilizing variable pressure water nozzles (3000 psi) and collection, removal, transportation and disposal of sand, debris, and liquid wastes to legal disposal sites.

B. Produce video using pan-and-tilt, radial viewing, pipe inspection camera that pans plus and minus 275 degrees and rotates 360 degrees. Use camera with accurate footage counter which displays on monitor exact distance of camera from starting manhole. Use camera with camera height adjustment so that camera lens is always centered at one-half inside diameter, or higher, in pipe being televised. Provide lighting system that allows features and condition of pipe to be clearly seen. Reflector in front of camera may be necessary to enhance lighting in dark or large diameter pipe.

C. Perform television inspection of gravity sanitary sewers as follows:

1. Videos shall pan beginning and ending manholes to demonstrate that debris has been removed. Camera operator shall slowly pan each service connection and where sewer transitions from one pipe material to another.
2. Video tapes shall be continuous for pipe segments between manholes. Do not leave gaps in video taping of segment between manholes and do not show single segment on more than one video tape.
3. No flow is allowed in gravity sanitary sewer while performing post-installation television inspection.

D. Provide video on CD in a format compatible with Windows Media Player. Two labels are required. Place one label on the case and the other on the face of each CD. Permanently label each video tape with the following information.

Face of CD

Wastewater File No.: _____ Contractor's Name: _____
Inspection Type: [ ] Survey [ ] Pre-Installation [ ] Post-Installation
Tape No.: _____ Date Televised: _____ Date Submitted: _____
Basin No.: _____

CD Case

Manhole No. From	Manhole No. To	Pipe Diameter	Pipe Length	Street

E. For each video tape provide completed TV Inspection Report, as attached at end of this section. TV Inspection Report is written/narrated log of pipe conditions and service connections, indexed to footage counter.

F. Upon completion of video tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

END OF SECTION 33 31 00

SECTION 33 31 00.10
ACCEPTANCE TESTING FOR SANITARY SEWERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Acceptance testing of sanitary sewers including:

1. Visual inspection of sewer pipes.
2. Mandrel testing for flexible sewer pipes.
3. Leakage testing of sewer pipes.
4. Leakage testing of manholes.
5. Smoke testing of point repairs.
6. All tests listed in this Section are not necessarily required on this Project. Required tests are named in other Sections which refer to this Section for testing criteria and procedures.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices.

1. No payment will be made for acceptance testing under this Section. Include payment in unit price for work requiring acceptance testing.
2. Refer to Division 1 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 C 828 - Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe Lines.

B. ASTM C 924 - Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method.

C. ASTM D 3034 - Standard Specification for Type PSM Polyethylene (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

D. ASTM F 794 - Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

E. ASTM F 1417 - Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low Pressure Air.

1.4 PERFORMANCE REQUIREMENTS

A. Gravity flow sanitary sewers are required to have straight alignment and uniform grade between manholes.

B. Flexible pipe, including "semi-rigid" pipe, is required to show no more than 5 percent deflection. Test pipe no sooner than 30 days after backfilling of line segment but prior to final acceptance using standard mandrel to verify that installed pipe is within specified deflection tolerances.

C. Maximum allowable leakage for Infiltration or Exfiltration.

1. The total exfiltration, as determined by hydrostatic head test, shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours at minimum test head of 2 feet above crown of pipe at upstream manhole or 2 feet above groundwater elevation, whichever is greater.
2. When pipes are installed more than 2 feet below groundwater level, use infiltration test in lieu of exfiltration test. Total infiltration shall not exceed 50 gallons per inch diameter per mile of pipe per 24 hours. Groundwater elevation must be at least 2 feet above crown of pipe at upstream manhole.
3. Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of Section, for measuring leakage in sewers. Perform leakage testing to verify that leakage criteria are met.

D. Perform air testing in accordance with requirements of this Section and Texas Natural Resources Conservation Commission requirements. Refer to Table 33 31 00.10-2, Time Allowed for Pressure Loss from 3.5 psig to 2.5 psig, Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test, and Table 33 31 00.10-4, Vacuum Test Time Table, at end of this Section.

1.5 SUBMITTALS

A. Conform to requirements of Division 1.

B. Test Plan: Before testing begins and in adequate time to obtain approval through submittal process, prepare and submit test plan for approval by Owner's Representative. Include testing procedures, methods, equipment, and tentative schedule. Obtain advance written approval for deviations from Drawings and Specifications.

C. Test Reports: Submit test reports for each test on each segment of sanitary sewer.

1.6 GRAVITY SANITARY SEWER QUALITY ASSURANCE

A. Repair, correct, and retest manholes or sections of pipe which fail to meet specified requirements when tested.

B. Provide testing reports and video tape of television inspection as directed by Owner's Representative.

C. Upon completion of tape reviews by Owner's Representative, Contractor will be notified regarding final acceptance of sewer segment.

1.7 SEQUENCING AND SCHEDULING

A. Perform testing as work progresses. Schedule testing so that no more than 1000 linear feet of installed sewer remains untested at one time.

B. Coordinate testing schedules with Owner's Representative. Perform testing under observation of Owner's Representative.

PART 2 P R O D U C T S

2.1 DEFLECTION MANDREL

A. Mandrel Sizing. Rigid mandrel shall have outside diameter (O.D.) equal to 95 percent of inside diameter (I.D.) of pipe. Inside diameter of pipe, for purpose of determining outside diameter of mandrel, shall be average outside diameter minus two minimum wall thicknesses for O.D. controlled pipe and average inside diameter for I.D. controlled pipe,

dimensions shall be per appropriate standard. Statistical or other "tolerance packages" shall not be considered in mandrel sizing.

B. Mandrel Design. Rigid mandrel shall be constructed of metal or rigid plastic material that can withstand 200 psi without being deformed. Mandrel shall have nine or more "runners" or "legs" as long as total number of legs is odd number. Barrel section of mandrel shall have length of at least 75 percent of inside diameter of pipe. Rigid mandrel shall not have adjustable or collapsible legs which would allow reduction in mandrel diameter during testing. Provide and use proving ring for modifying each size mandrel.

C. Proving Ring. Furnish "proving ring" with each mandrel. Fabricate ring of 1/2-inch-thick, 3-inch-wide bar steel to diameter 0.02 inches larger than approved mandrel diameter.

D. Mandrel Dimensions (5 percent allowance). Average inside diameter and minimum mandrel diameter are specified in Table 30 31 00.10-5, Pipe vs. Mandrel Diameter, at end of this Section. Mandrels for higher strength, thicker wall pipe or other pipe not listed in table may be used when approved by Owner’s Representative.

2.2 EXFILTRATION TEST

A. Water Meter: Obtain transient water meter from appropriate governmental agency for use when water for testing will be taken from public system. Conform to governmental agency requirements for water meter use.

B. Test Equipment:

1. Pipe plugs.
2. Pipe risers where manhole cone is less than 2 feet above highest point in pipe or service lead.

2.3 INFILTRATION TEST

A. Test Equipment:

1. Calibrated 90 degree V-notch weir.
2. Pipe plugs.

2.4 LOW PRESSURE AIR TEST

A. Minimum Requirement for Equipment:

1. Control panel.
2. Low-pressure air supply connected to control panel.
3. Pneumatic plugs: Acceptable size for diameter of pipe to be tested; capable of withstanding internal test pressure without leaking or requiring external bracing.
4. Air hoses from control panel to:
    a. Air supply.
    b. Pneumatic plugs.
    c. Sealed line for pressuring.
    d. Sealed line for monitoring internal pressure.

B. Testing Pneumatic Plugs: Place pneumatic plug in each end of length of pipe on ground. Pressurize plugs to 25 psig; then pressurize sealed pipe to 5 psig. Plugs are acceptable when they remain in place against test pressure without external aids.

2.5 GROUND WATER DETERMINATION

A. Equipment: Pipe probe or small diameter casing for ground water elevation determination.

2.6 SMOKE TESTING

A. Equipment:

1. Pneumatic plugs.
2. Smoke generator as supplied by Superior Signal Company, or approved equal.
3. Blowers producing 2500 scfm minimum.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Provide labor, equipment, tools, test plugs, risers, air compressor, air hose, pressure meters, pipe probe, calibrated weirs, or any other device necessary for proper testing and inspection.

B. Determine selection of test methods and pressures for gravity sanitary sewers based on ground water elevation. Determine ground water elevation using equipment and procedures conforming to Division 1.

3.2 VISUAL INSPECTION OF GRAVITY SANITARY SEWERS

A. Check pipe alignment visually by flashing light between structures. Verify if alignment is true and no pipes are misplaced. In case of misalignment or damaged pipe, remove and re-lay or replace pipe segment.

3.3 MANDREL TESTING FOR GRAVITY SANITARY SEWERS

A. Perform deflection testing on flexible and semi-rigid pipe to confirm pipe has no more than 5 percent deflection. Mandrel testing shall conform to ASTM D 3034. Perform testing no sooner than 30 days after backfilling of line segment, but prior to final acceptance testing of line segment.

B. Pull approved mandrel by hand through sewer sections. Replace any section of sewer not passing mandrel. Mandrel testing is not required for stubs.

C. Retest repaired or replaced sewer sections.

3.4 LEAKAGE TESTING FOR GRAVITY SANITARY SEWERS

A. Test Options:

1. Test gravity sanitary sewer pipes for leakage by either exfiltration or infiltration methods, as appropriate, or with low pressure air testing.
2. Test new or rehabilitated sanitary sewer manholes with water or low pressure air. Manholes tested with low pressure air shall undergo physical inspection prior to testing.
3. Perform leakage testing after backfilling of line segment, and prior to tie-in of service connections.
4. If no installed piezometer is within 500 feet of sewer segment, provide temporary piezometer for this purpose.

B. Compensating for Ground Water Pressure:

1. Where ground water exists, install pipe nipple at same time sewer line is placed. Use 1/2-inch capped pipe nipple approximately 10 inches long. Make installation through manhole wall on top of sewer line where line enters manhole.
2. Immediately before performing line acceptance test, remove cap, clear pipe nipple with air pressure, and connect clear plastic tube to nipple. Support tube vertically and allow water to rise in tube. After water stops rising, measure height in feet of water over invert of pipe. Divide this height by 2.3 feet/psi to determine ground water pressure to be used in line testing.

C. Exfiltration test:

1. Determine ground water elevation.
2. Plug sewer in downstream manhole.
3. Plug incoming pipes in upstream manhole.
4. Install riser pipe in outgoing pipe of upstream manhole when highest point in service lead (house service) is less than 2 feet below bottom of manhole cone.
5. Fill sewer pipe and manhole or pipe riser, when used, with water to point 2-1/2 feet above highest point in sewer pipe, house lead, or ground water table, whichever is highest.
6. Allow water to stabilize for one to two hours. Take water level reading to determine drop of water surface, in inches, over one-hour period, and calculate water loss (1 inch of water in 4 feet diameter manhole equals 8.22 gallons) or measure quantity of water required to keep water at same level. Loss shall not exceed that calculated from allowable leakage according to Table 33 31 00.10-1 at end of this Section.

D. Infiltration test: Ground water elevation must be not less than 2.0 feet above highest point of sewer pipe or service lead (house service).

1. Determine ground water elevation.
2. Plug incoming pipes in upstream manhole.
3. Insert calibrated 90 degree V-notch weir in pipe on downstream manhole.
4. Allow water to rise and flow over weir until it stabilizes.
5. Take five readings of accumulated volume over period of 2 hours and use average for infiltration. Average must not exceed that calculated for 2 hours from allowable leakage according to Table 33 31 00.10-1 at end of this Section.

E. Low Air Pressure Test: When using this test conform to ASTM C 828, ASTM C 924, or ASTM F 1417, as applicable, with holding time not less than that listed in Table 33 01 30-2.

1. Air testing for sections of pipe shall be limited to lines less than 36-inch average inside diameter.
2. Lines 36-inch average inside diameter and larger shall be tested at each joint. Minimum time allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch during joint test shall be 10 seconds, regardless of pipe size.
3. For pipe sections less than 36-inch average inside diameter:
    a. Determine ground water level.
    b. Plug both ends of pipe. For concrete pipe, flood pipe and allow 2 hours to saturate concrete. Then drain and plug concrete pipe.
    c. After manhole-to-manhole section of sanitary sewer main has been sliplined and prior to any service lines being connected to new liner, plug liner at each manhole with pneumatic plugs.
    d. Pressurize pipe to 4.0 psig. Increase pressure 1.0 psi for each 2.3 feet of ground water over highest point in system. Allow pressure to stabilize for 2 to 4 minutes. Adjust pressure to start at 3.5 psig (plus adjustment for ground water table). See Table 33 31 00.10-2 at end of this Section.

e. To determine air loss, measure time interval for pressure to drop to 2.5 psig. Time must exceed that listed in Table 33 31 00.10-2 at end of this Section for pipe diameter and length. For sliplining, use diameter of carrier pipe.

F. Retest: Repair and retest any section of pipe which fails to meet requirements.

3.5 TEST CRITERIA TABLES

A. Exfiltration and Infiltration Water Tests: Refer to Table 33 31 00.10-1, Water Test Allowable Leakage, at end of this Section.

B. Low Pressure Air Test:

1. Times in Table 33 31 00.10-2, Time Allowed For Pressure Loss From 3.5 psig to 2.5 psig, at end of this Section, are based on equation from Texas Natural Resources and Conservation Commission (TNRCC) Design Criteria 317.2(a)(4)(B).

		$T = 0.0850(D)(K)/(Q)$
Where:	T =	Time for pressure to drop 1.0 pounds per square inch gauge in seconds
	K =	0.000419 DL, but not less than 1.0
	D =	Average inside diameter in inches
	L =	Length of line of same pipe size in feet
	Q =	Rate of loss, 0.0015 ft^3/min./sq. ft. internal surface

2. Since K value of less than 1.0 shall not be used, there are minimum testing times for each pipe diameter as given in Table 33 31 00.10-3, Minimum Testing Times for Low Pressure Air Test.

Notes:
1. When two sizes of pipe are involved, compute time by ratio of lengths involved.
2. Lines with 27-inch average inside diameter and larger may be air tested at each joint.
3. Lines with average inside diameter greater than 36 inches must be air tested for leakage at each joint.
4. If joint test is used, perform visual inspection of joint immediately after testing.
5. For joint test, pipe is to be pressurized to 3.5 psi greater than pressure exerted by groundwater above pipe. Once pressure has stabilized, minimum times allowable for pressure to drop from 3.5 pounds per square inch gauge to 2.5 pounds per square inch gauge shall be 10 seconds.

3.6 LEAKAGE TESTING FOR MANHOLES

A. After completion of manhole construction, wall sealing, or rehabilitation, but prior to backfilling, test manholes for water tightness using hydrostatic or vacuum testing procedures.

B. Plug influent and effluent lines, including service lines, with suitably-sized pneumatic or mechanical plugs. Ensure plugs are properly rated for pressures required for test; follow manufacturer's safety and installation recommendations. Place plugs minimum of 6 inches outside of manhole walls. Brace inverts to prevent lines from being dislodged when lines entering manhole have not been backfilled.

C. Vacuum testing:

1. Install vacuum tester head assembly at top access point of manhole and adjust for proper seal on straight top section of manhole structure. Following manufacturer's instructions and safety precautions, inflate sealing element to recommended maximum inflation pressure; do not over-inflate.
2. Evacuate manhole with vacuum pump to 10 inches mercury (Hg), disconnect pump, and monitor vacuum for time period specified in Table 33 31 00.10-4, Vacuum Test Time Table.
3. If drop in vacuum exceeds 1 inch Hg over specified time period tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

D. Perform hydrostatic exfiltration testing as follows:

1. Seal wastewater lines coming into manhole with internal pipe plug. Then fill manhole with water and maintain it full for at least one hour.
2. The maximum leakage for hydrostatic testing shall be 0.025 gallons per foot diameter per foot of manhole depth per hour.
3. If water loss exceeds amount tabulated above, locate leaks, complete repairs necessary to seal manhole and repeat test procedure until satisfactory results are obtained.

3.7 SMOKE TEST PROCEDURE FOR POINT REPAIRS

A. Application: Perform smoke test to:

1. Locate points of line failure for point repair.
2. Determine when point repairs are properly made.
3. Determine when service connections have been reconnected to rehabilitated sewer.
4. Check integrity of connections to newly replaced service taps to liners and to existing private service connections.

B. Limitations: Do not backfill service taps until completion of this test. Test only those taps in single manhole section at one time. Keep number of open excavations to minimum.

C. Preparation: Prior to smoke testing, give written notices to area residents no fewer than 2 days, nor more than 7 days, prior to proposed testing. Also give notice to Police and Fire Departments 24 hours prior to actual smoke testing.

D. Isolate Section: Isolate manhole section to be tested from adjacent manhole sections to keep smoke localized. Temporarily seal annular space at manhole for sliplined sections.

E. Smoke Introduction:

1. Operate equipment according to manufacturer's recommendation and as approved by Owner’s Representative.
2. Conduct test by forcing smoke from smoke generators through sanitary sewer main and service connections. Operate smoke generators for minimum of 5 minutes.
3. Introduce smoke into upstream and downstream manhole as appropriate. Monitor tap/connection for smoke leaks. Note sources of leaks.

F. Repair and Retest: Repair and replace taps or connections noted as leaking and then retest. Taps and connections may be left exposed in only one manhole section at time. When repair or replacement, testing or retesting, and backfilling of excavation is not completed within one work day, properly barricade and cover each excavation as approved by Owner’s Representative.

G. Service Connections: On houses where smoke does not issue from plumbing vent stacks to confirm reconnection of sewer service to newly installed liner pipe, perform dye test to confirm reconnection. Introduce dye into service line through plumbing fixture inside structure or sewer cleanout immediately outside structure and flush with water. Observe flow at service reconnection or downstream manhole. Detection of dye confirms reconnection.

Table 33 31 00.10-1

WATER TEST ALLOWABLE LEAKAGE

DIAMETER OF RISER OR STACK IN INCHES	VOLUME PER INCH OF DEPTH		ALLOWANCE LEAKAGE*	
	INCH	GALLONS	PIPE SIZE IN INCHES	GALLONS/MINUTE PER 100 FEET
1	0.7854	.0034	6	0.0039
2	3.1416	.0136	8	0.0053
2.5	4.9087	.0212	13	0.0066
3	7.0686	.0306	12	0.0079
4	12.5664	.0306	15	0.0099
5	19.6350	.0544	18	0.0118
6	28.2743	.1224	21	0.0138
8	50.2655	.2176	24	0.0158
			27	0.0177
			30	0.0197
			36	0.0237
			42	0.0276
For other diameters, multiply square of diameters by value for 1” diameter.			Equivalent to 50 gallons per inch of inside diameter per mile per 24 hours.	

* Allowable leakage rate shall be reduced to 10 gallons per inch of inside diameter per mile per 24 hours, when sewer is identified as located within 25-year flood plain.

Table 33 31 00.10-2
ACCEPTANCE TESTING FOR SANITARY SEWERS

TIME ALLOWED FOR PRESSURE LOSS FROM 3.5 PSIG TO 2.5 PSIG														
Pipe Diam. (in.)	Min. Time	Length For Min. Time (ft)	Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)										
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	500 ft	550 ft	600 ft
6	5:40	398	0.8548	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:25	7:07	7:50	8:33
8	7:33	298	1.5196	7:33	7:33	7:33	7:33	7:36	8:52	10:08	11:24	12:40	13:56	15:12
10	9:27	239	2.3743	9:27	9:27	9:27	9:54	11:52	13:51	15:50	17:48	19:47	21:46	23:45
12	11:20	199	3.4190	11:20	11:20	11:20	14:15	17:06	19:57	22:48	25:39	28:30	31:20	34:11
15	14:10	159	5.3423	14:10	14:10	17:48	22:16	26:43	31:10	35:37	40:04	44:31	48:58	53:25
18	17:00	133	7.6928	17:00	19:14	25:39	32:03	38:28	44:52	51:17	57:42	64:06	70:31	76:56
21	19:50	114	10.4708	19:50	26:11	35:54	43:38	52:21	61:05	69:48	78:32	87:15	95:59	104:42
24	22:40	99	13.6762	22:48	34:11	45:35	56:59	68:23	79:47	91:10	102:34	113:58	125:22	136:46
27	25:30	88	17.3089	28:51	43:16	57:42	72:07	86:33	100:58	115:24	129:49	144:14	158:40	173:05
30	28:20	80	21.3690	35:37	53:25	71:14	89:02	106:51	124:39	142:28	160:16	178:05	195:53	213:41
33	31:10	72	25.8565	43:06	64.38	86:11	107:44	129:17	150:50	172:23	193:55	215:28	237:01	258:34

Table 33 31 00.10-3
MINIMUM TESTING TIMES FOR LOW PRESSURE AIR TEST

Pipe Diameter (inches)	Minimum Time (seconds)	Length for Minimum Time (feet)	Time for Longer Length (seconds)
6	340	398	0.855 (L)
8	454	298	1.520 (L)
10	567	239	2.374 (L)
12	680	199	3.419 (L)
15	850	159	5.342 (L)
18	1020	133	7.693 (L)
21	1190	114	10.471 (L)
24	1360	100	13.676 (L)
27	1530	88	17.309 (L)
30	1700	80	21.369 (L)
33	1870	72	25.856 (L)

Table 33 31 00.10-4
VACUUM TEST TIME TABLE

DEPTH IN FEET	TIME IN SECONDS BY PIPE DIAMETER		
	48”	60”	72”
4	10	13	16
8	20	26	32
12	30	39	48
16	40	52	64
20	50	65	80
24	60	78	96
*	5.0	6.5	8.0
*Add T times for each additional 2-foot depth. (The values listed above have been extrapolated from ASTM C 924-85)			

Table 33 31 00.10-5
PIPE VS. MANDREL DIAMETER

Material and Wall Construction	Nominal Size (Inches)	Average I.D. (Inches	Minimum Mandrel Diameter (Inches)
PVC-Solid (SDR 26)	6	5.764	5.476
	8	7.715	7.329
	10	9.646	9.162
PVC-Solid (SDR 35)	12	11.737	11.150
	15	14.374	13.655
	18	17.629	16.748
	21	20.783	19.744
	24	23.381	22.120
	27	26.351	25.033
PVC-Truss	8	7.750	7.363
	10	9.750	9.263
	12	11.790	11.201
	15	14.770	14.032
PVC-Profile (ASTM F 794)	12	11.740	11.153
	15	14.370	13.652
	18	17.650	16.768
	21	20.750	19.713
	24	23.500	22.325
	27	26.500	25.175
	30	29.500	28.025
	36	35.500	33.725
	42	41.500	39.425
	48	47.500	45.125
HDPE-Profile	18	18.000	17.100
	21	21.000	19.950
	24	24.000	22.800
	27	27.000	25.650
	30	30.000	28.500
	36	36.000	34.200
	42	42.000	39.900
	48	48.000	45.600
	54	54.000	51.300
	60	60.000	57.000
Fiberglass (Class SN 46)	12	12.85	11.822
	18	18.66	17.727
	20	20.68	19.646
	24	24.72	23.484
	30	30.68	29.146
	36	36.74	34.903
	42	42.70	40.565
	48	48.76	46.322
	54	54.82	52.079
	60	60.38	57.361

END OF SECTION 33 31 00.10

SECTION 33 41 00

STORM UTILITY DRAINAGE PIPING

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. New storm sewers and appurtenances, modifications to existing storm sewer system and installation of roadside ditch culverts.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. Payment for storm sewers, including elliptical or box, installed by open-cut, augered with or without casing, or tunneling is on linear foot basis. Measurement for storm sewers and roadside ditch culverts will be taken along center line of pipe from center line to center line of manholes or from end to end of culverts. Payment will be made for each linear foot installed complete in place, including connections to existing manholes and inlets.
2. Payment for storm sewer leads, including elliptical leads, is on a linear foot basis.
3. Payment for corrugated metal pipe storm sewer outfall, including timber bents, is on a linear foot basis.
4. Refer to Division 1 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 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit manufacturer's literature for product specifications and installation instructions.

C. Submit proposed methods, equipment, materials, and sequence of operations for sewer construction. Plan operations to minimize disruption of utilities to occupied facilities or adjacent property.

1.4 QUALITY ASSURANCE

A. The Condition for acceptance shall be watertight storm sewer that is watertight both in pipe-to-pipe joints and in pipe-to-manhole connections.

B. Provide manufacturer's certification to Specifications.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's recommendations.

B. Handle pipe, fittings, and accessories carefully with approved handling devices. Do not drop or roll pipe off trucks or trailers. Do not use Materials cracked, gouged, chipped, dented, or otherwise damaged shall not be use materials for installation.

C. Store pipe and fittings on heavy timbers or platforms to avoid contact with ground.

D. Unload pipe, fittings, and appurtenances as close as practical to location of installation to avoid unnecessary handling.

E. Keep interiors of pipe and fittings free of dirt and foreign matter.

F. Store PVC pipe out of direct sunlight.

PART 2 P R O D U C T S

2.1 PIPE

A. Provide piping materials for storm sewers shall be of sizes and types specified unless otherwise indicated on Drawings.

B. In diameters where material alternatives are available, provide pipe from single manufacturer for each pipe diameter, unless otherwise approved by Owner's Representative or otherwise shown on Drawings.

C. Existing pipe that has been removed during construction cannot be reused.

2.2 PIPE MATERIAL SCHEDULE

A. Storm Sewer Pipe: Use pipe materials that conforming to requirements specified in Division 33 and as shown on the Drawings.

B. Driveway Culvert Pipe for Streets with Open Ditches: Use pipe materials that conforming to requirements specified Division 33 and as shown on the Drawings.

C. Provide pipe meeting minimum class, dimension ratio, or other criteria indicated.

D. Pipe materials other than those listed above shall not be used for storm sewers.

2.3 BEDDING, BACKFILL, AND TOPSOIL MATERIAL

A. Bedding and Backfill Material: Conform to requirements of Division 31.

B. Topsoil: Conform to requirements of Division 32.

C. Use cement stabilized sand material for bedding and backfill in the pipe zone for all storm sewers.

PART 3 E X E C U T I O N

3.1 PREPARATION

A. Prepare traffic control plans and set up street detours and barricades in preparation for excavation when construction will affects traffic. Conform to requirements of Division 1.

B. Provide barricades, flashing warning lights, and signs for excavations. Conform to requirements of Division 1. Maintain barricades and warning lights for streets and intersections while Work is in progress or where traffic is affected by Work.

C. Immediately notify agency or company owning utility lines which are damaged, broken, or disturbed. Obtain approval from Owner's Representative and agency for repairs or relocations, either temporary or permanent.

D. Remove old pavements and structures, including sidewalks and driveways in accordance with requirements of Division 2.

E. Install and operate dewatering and surface water control measures in accordance with Division 1.

3.2 EXCAVATION

A. Earthwork. Conform to requirements of Division 31. Use bedding as indicated on Drawings.

B. Line and Grade. Establish required uniform line and grade trench from benchmarks identified by Owner's Representative. Maintain this control for minimum of 100 feet behind and ahead of pipe-laying operation. Use laser beam equipment to establish and maintain proper line and grade of Work. Or use of appropriately sized grade boards which are substantially supported.

C. Trench Excavation. Excavate pipe trenches to level as indicated on Standard Details. Backfill excavation with specified bedding material to level of lower one-third of pipe barrel. Tamp and compact backfill to provide bedding at indicated grade. Form bedding foundation to minimum depth of one-eighth of pipe diameter, but not less than 6 inches.

3.3 PIPE INSTALLATION

A. Install in accordance with pipe manufacturer's recommendations and as specified in this section.

B. Install pipe only after excavation is completed, bottom of trench is shaped, bedding material is installed, and trench has been approved by Owner's Representative.

C. Install pipe to line and grade indicated on Drawings. Place pipe so that it has continuous bearing of barrel on bedding material with no voids, and is laid in trench so interior surfaces of pipe follows grades and alignments indicated.

D. Install pipe with bells of pipe facing upstream of anticipated flow.

E. Form concentric joint with each section of adjoining pipe to prevent offsets.

F. Place and drive home newly laid sections with a sling or come-a-long winches to eliminate damage to sections. Unless otherwise approved by Owner's Representative, provide end protection to prevent damage while using back hoes or similar powered equipment to drive home newly laid sections.

G. Keep interior of pipe clean as installation progresses.

H. Keep excavations free of water during construction and until final inspection.

I. When work is not in progress, cover exposed ends of pipes with pipe plug specifically designed to prevent foreign material from entering pipe.

J. For PVC Pipe:

1. Provide a minimum cover as per manufacturer’s requirements from top of pavement to top of pipe, but no less than 2 feet.
2. Accomplish transitions to different material of pipe in a manhole or inlet box. No adapter, coupling for dissimilar pipe, or saddle connections allowed.
3. Provide pipe sections in standard lengths with minimum length of 13 feet. Pipe may be field modified to shorten length no less than 4 feet, unless otherwise approved by Owner’s Representative. Field modify pipe per manufacturer's recommendations.
4. No beveling at joint allowed. Cut to be perpendicular to longitudinal axis.
5. Provide gasketed bell and spigot joints installed per manufacturer's recommendations. Gasketed pipe joints; clean and free of debris, show no leakage after installation.

3.4 PIPE INSTALLATION OTHER THAN OPEN CUT

A. Conform to requirements of Division 33 where required.

B. Not allowed for plastic sewer pipe.

3.5 INSTALLATION OF APPURTENANCES

A. Construct manholes to conform to requirements of Division 33. Install frames, grate rings, and covers to conform to requirements of Division 33.

B. Install PVC pipe culverts with approved end treatments. Approved end treatments include concrete headwalls, wingwalls and collars.

C. Install inlets, headwalls, and wingwalls to conform to requirements of Division 33.

D. Rehabilitate existing manholes to conform to requirements of Division 33. Adjust manhole covers and inlets to grade conforming to requirements of Division 33.

E. Dimension for Type C and Type E manholes shall be as shown on Drawings.

3.6 INSPECTION AND TESTING

A. Perform post installation television inspection in accordance with Division 33. Hand held cameras may be used in storm sewers in lieu of requirements Division 33. Clearly stencil distance markings on each joint of pipe to indicate distance from starting manhole when using hand held cameras.

3.7 BACKFILL AND SITE CLEANUP

A. Backfill trench after pipe installation is inspected and approved by Owner’s Representative.

B. Backfill and compact soil in accordance with Division 31.

C. Repair and replace removed or damaged pavement and sidewalks as specified in Division 32.

D. In unpaved areas, grade surface as uniform slope to natural grade as indicated on Drawings. Provide minimum of 4 inches of topsoil and seed according to requirements of Division 32 as required.

END OF SECTION 33 41 00

SECTION 33 49 13

STORM DRAINAGE MANHOLES, FRAMES AND COVERS

PART 1 G E N E R A L

1.1 SECTION INCLUDES

A. Iron castings for manhole frames and covers, inlet frames and grates, catch basin frames and grates, meter vault frames and covers, adjustment rings, and extensions.

B. Ring grates.

1.2 MEASUREMENT AND PAYMENT

A. Unit Prices

1. No payment will be made for frames, grates, rings, covers, and seals under this Section. Include payment in unit price for related item.
2. Payment to rack over existing manhole is on a unit price basis for each manhole.
3. Refer to Division 1 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. AASHTO -American Association of State Highway and Transportation Officials Standard Specification for Highway Bridges

B. ASTM A 48 -Standard Specification for Gray Iron Castings

C. ASTM A 615 -Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

D. AWS -D 12.1 Welding Reinforcing Steel.

1.4 SUBMITTALS

A. Conform to requirements of Division 1.

B. Submit copies of manufacturer's specifications, load tables, dimension diagrams, anchor details, and installation instructions.

C. Submit shop drawings for fabrication and installation of casting assemblies that are not included in Drawings or standard City details. Include plans, elevations, sections and connection details. Show anchorage and accessory items. Include setting drawings for location and installation of castings and anchorage devices.

PART 2 P R O D U C T S

2.1 CASTINGS

A. Use castings for frames, grates, rings and covers conforming to ASTM A 48, Class 35B. Provide locking covers if indicated on Drawings.

B. Use clean castings capable of withstanding application of AASHTO M306-40,000 pound proof loading without detrimental permanent deformation.

C. Fabricate castings to conform to shapes, dimensions, and with wording or logos shown on Drawings. Standard dimensions for manhole covers are 32 inches in diameter.

D. Use clean castings, free from blowholes and other surface imperfections. Use clean and symmetrical cast holes in covers, free of plugs.

2.2 BEARING SURFACES

A. Machine bearing surfaces between covers or grates and their respective frames so that even bearing is provided for position in which casting may be seated in frame.

2.3 SPECIAL FRAMES AND COVERS

A. Where indicated on Drawings, provide watertight manhole frames and covers with minimum of four bolts and gasket designed to seal cover to frame. Supply approved watertight manhole covers and frames.

B. Where shown on Drawing, provide manhole frames and covers with 48 inch diameter clear opening, with inner cover for 22 inch diameter clear opening. Provide approved inner cover with pattern shown on Drawings.

2.4 FINISH

A. Unless otherwise specified, uncoated cast iron.

2.5 FABRICATED RING GRATE

A. Fabricate ring grates from reinforcing steel conforming to ASTM A 615.

B. Conform to welds connecting bars to AWS D 12.1.

2.6 ADJUSTMENT RINGS FOR ASPHALT OVERLAYS

A. Use castings conforming to Division 33 requirements.

B. One piece casting with dimensions to fit frame and cover.

PART 3 E X E C U T I O N

3.1 INSTALLATION

A. Install castings according to approved shop drawings, instructions in related specifications, and applicable directions from manufacturer's printed materials.

B. Set castings accurately at required locations to proper alignment and elevation. Keep castings plumb, level, true, and free of rack. Measure location accurately from established lines and grades. Brace or anchor frames temporarily in form work until permanently set.

C. Fabricate ring grates in accordance with City of Houston standard detail, "Ring Grate for Open End of 18 Inch to 72 Inch Stubs to Ditch". Set in mortar in mouth of pipe bell.

D. Install adjustment rings in existing frames with clean bearing surfaces that are free from rocking.

END OF SECTION 33 49 13

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VLK